MARCH Reg. U.S. Pat. Off. 25 Cents

Popular Science

Founded MONTHLY

Ready to Battle with the Deep—See Page 84

Twenty years

Twenty years old, born at a dollar and not raised yet

EXTRA RADIO BLADES 6 FOR 40¢

American Safety Razor Corporation
BROOKLYN N.Y.

FACTORIES
NEW YORK · BROOKLYN · TORONTO · LONDON

$1.00 COMPLETE

'Ever-Read
Safety Razor

You hear the real Caruso

TO hear the real Caruso—to hear all the greatest artists of the world in your own home just as they want you to hear them, it is as necessary that you should have a Victrola as that you should have their Victor Records.

The Victrola and Victor Records are scientifically coordinated and synchronized in the processes of manufacture, making it necessary to use them *together* to achieve a perfect result. The greatest singers and instrumentalists are Victor artists not only because their interpretations are so faithfully recorded on Victor Records, but because the Victrola is the one instrument that plays them with the degree of perfection and beauty of tone that meets the approval of the artists themselves.

When you play Victor Records on the Victrola—and only on the Victrola—you really hear these great artists exactly as they themselves heard and approved their own work.

Any Victor dealer will gladly play any music you wish to hear. Victrolas $25 to $1500. New Victor Records demonstrated at all dealers on the 1st of each month.

Victor Talking Machine Co.
Camden, N. J.

VICTROLA

BUNGALOW FOLKS

mostly know (and the rest are learning fast) that there really is only one wood for Bungalows—and that is "Cypress, of course." *Write for Volume 5*, Cypress Pocket Library—very complete general treatises by well-known architects, covering all the puzzling questions on Bungalow building, from designs to furnishing—sent promptly with our compliments upon your request.

The less you have to spend in building, the more important it is that you secure the longest possible life for your investment. The *more* you spend the more important it is that your money shall represent a definite and permanent investment, and not have to be spent over again in exasperating repairs. Cypress is "the one best buy" in the entire wood market for those who care what they get for their lumber money. Because it lasts and lasts and lasts and lasts and LASTS.

Write for VOL. 5 TODAY. Now is the best time.

Let our **"ALL-AROUND HELPS DEPARTMENT"** help YOU. Our entire resources are at your service with Reliable Counsel. We invite Correspondence with a serious purpose in it.

Southern Cypress Manufacturers' Association

1249 Hibernia Bank Building, New Orleans, La., or 1249 Heard Nat'l Bank Bldg., Jacksonville, Fla.

INSIST ON TRADE-MARKED CYPRESS AT YOUR LOCAL LUMBER DEALER'S. IF HE HASN'T IT, *LET US KNOW IMMEDIATELY*

Popular Science Monthly

MARCH, 1920

Volume 96-No. 3

CONTENTS

AERONAUTICS — Page

A Flying-Boat that Sheds Its Wings 25
See Carries Passengers Instead of Bombs 45
How Much Wind Can She Stand? 54
Self-Starters for Airplanes 57
Fireproofing the Air Mail 59
Flying Straight Up with Whirling Wings 76
Turning Airplanes into Seaplanes 80
Wrecked Aviators Need Not Drown 86
The Price of a Zeppelin Ride 88

INDUSTRIAL PROGRESS

Mining Coal from the Bottom of a River 26
A Hook that Holds the Solder-Pot Securely 26
The New Iron Bucket 26
A Concrete Chute on a Bicycle 27
A Vacuum Cup to Open Tight Watch-Cases 27
Thawing Ground by Electricity 32
The Spring Is the Other Man 32
Testing Building Materials by Fire 33
A New Way to Test Metals 36
This Apparatus Tests Sand on the Job 40
In Behalf of Window-Washers 44
Here's Maxim's House of Silence 48
Piling Pulled Out by Hydraulics 48
Whirling Molten Iron into Pipe 50
Saving Fallen Fruit 50
Cooling Off Underground Electric Cables 50
Hand Lettering by Machine 51
Chasing the Rats Out of England 51
Using Compressed Air to Mix Paint 54
Harnessing a Spring to Pump Itself 56
Lifting a Heavy Caldron Without a Crane 59
A Machine Even for Winding Watches 59
Making It Easy to Handle Molten Metal 60
Turn on the Gas Like Electricity 60
Making Brass in an Electric Furnace 62
A Grip for the Rivet 62
Raising Sunken Ships with Hollow Towers 67
Helping the Farmer Pack His Fruit 68
Jumping the Dams with Your Ship 69
A Fight Between a Steam and an Electric Engine 80
Making Liquid Air 88
To Measure the Depth of a Well 88
Look Out, Below! 88
Slicing Off Steel Car Wheels 89

(*Continued on page 4*)

Copyright, 1920, by the Modern Publishing Company.

POPULAR SCIENCE MONTHLY is issued monthly. Yearly subscription in the United States, $3.00. Canada, $3.50. Foreign, $4.00. Single copy, 25 cents.

POPULAR SCIENCE MONTHLY may be had at all newsstands in the United States and Canada; also from the International News Company, London, and at Brentano's, Paris.

Advertising rates on application. Forms close the twentieth of the second month preceding date of publication. Entered as second-class matter Dec. 28, 1915, at the Post Office at New York under the act of March 3, 1879. Entered as second-class matter at the Post Office Department, Canada.

The contents of this magazine are copyrighted and must not be reprinted without permission.

H. J. Fisher, President; R. C. Wilson, Vice-President; O. B. Capen, Secretary and Treasurer.

Modern Publishing Company
225 West Thirty-ninth St. New York City

How I Improved My Memory In One Evening

The Amazing Experience of Victor Jones

"OF *course* I place you! Mr. Addison Sims of Seattle.

"If I remember correctly—and I *do* remember correctly—Mr. Burroughs, the lumberman, introduced me to you at the luncheon of the Seattle Rotary Club three years ago in May. This is a pleasure indeed! I haven't laid eyes on you since that day. How is the grain business? And how did that amalgamation work out?"

The assurance of this speaker—in the crowded corridor of the Hotel McAlpin—compelled me to turn and look at him, though I must say it is not my usual habit to "listen in" even in an hotel lobby.

"He is David M. Roth, the most famous memory expert in the United States," said my friend Kennedy, answering my question before I could get it out. "He will show you a lot more wonderful things than that, before the evening is over."

And he did.

And as he went into the banquet room the toastmaster was introducing a long line of the guests to Mr. Roth. I got in line and when it came my turn, Mr. Roth asked, "What are your initials, Mr. Jones, and your business connection and telephone number?" "Why he asked this, I learned later, when he picked from the crowd the sixty men he had met two hours before and called each by name without a mistake. What is more, he named each man's business and telephone number, for good measure.

I won't tell you all the other amazing things this man did except to tell how he called back, without a minute's hesitation, long lists of numbers, bank clearings, prices, lot numbers, parcel post rates and anything else the guests gave him in rapid order.

* * * * *

When I met Mr. Roth—which you may be sure I did the first chance I got—he rather bowled me over by saying, in his quiet, modest way:

"There is nothing miraculous about my remembering anything I want to remember, whether it be names, faces, figures, facts, or something I have read in a magazine.

"*You can do this just as easy as I do.* Anyone with an average mind can learn quickly to do exactly the same things which seem so miraculous when I do them.

"My own memory," continued Mr. Roth, "was originally very faulty. Yes it was—a really *poor* memory. On meeting a man I would lose his name in thirty seconds, while now there are probably 10,000 men and women in the United States, many of whom I have met but once, whose names I can call instantly on meeting them."

"That is all right for you, Mr. Roth," I interrupted, "you have given years to it. But how about me?"

"Mr. Jones," he replied, "I can teach you the secret of a good memory in one evening. This is not a guess, because I have done it with thousands of pupils. In the first of seven simple lessons which I have prepared for home study, I show you the basic principle of my whole system and you will find it—not hard work as you might fear—but just like playing a fascinating game. I will prove it to you."

He didn't have to prove it. His course did; I got it the very next day from his publishers, the Independent Corporation.

When I tackled the first lesson, I suppose I was the most surprised man in forty-eight states to find that I had learned in about one hour—how to remember a list of one hundred words so that I could call them off forward and back without a single mistake.

That first lesson *stuck*. And so did the other six.

Read this letter from Terence J. McManus, of the firm of Olcott, Bonynge, McManus & Ernst, Attorneys and Counsellors at Law, 170 Broadway, and one of the most famous trial lawyers in New York:

> "May I take occasion to state that I regard your service in giving this system to the world as a public benefaction. The wonderful simplicity of the method, and the ease with which its principles can be acquired, especially appeal to me. I may add that I already had occasion to test the effectiveness of the first two lessons in the preparation for trial of an important action in which I am about to engage."

Mr. McManus didn't put it a bit too strong. The Roth course is priceless! I can absolutely *count* on my memory now. I can call the name of most any man I have met before—and I am getting better all the time. I can remember any figures I wish to remember. Telephone numbers come to mind instantly, once I have filed them by Mr. Roth's easy method. Street addresses are just as easy.

The old fear of forgetting (you know what that is) has vanished. I used to be "scared stiff" on my feet—because I wasn't *sure*. I couldn't remember what I wanted to say.

Now I am sure of myself, and confident, and "easy as an old shoe" when I get on my feet at the club, or at a banquet, or in a business meeting, or in any social gathering.

Perhaps the most enjoyable part of it all is that I have become a good conversationalist—and I used to be silent as a sphinx when I got into a crowd of people who knew things.

Now I can call up like a flash of lightning most any fact I want right at the instant I need it most. I used to think a "hair trigger" memory belonged only to the prodigy and genius. Now I see that every man of us has that kind of a memoryif he only knows how to make it work right.

I tell you it is a wonderful thing, after groping around in the dark for so many years to be able to switch the big searchlight on your mind and see instantly everything you want to remember.

This Roth course will do wonders in your office.

Since we took it up you never hear anyone in *our* office say "I guess" or "I think it was about so much" or "I forgot that right now" or "I can't remember" or "I must look up his name." Now they are right there with the answer—like a shot.

Have you ever heard of "Multigraph" Smith? Real name H. Q. Smith, Division Manager of the Multigraph Sales Company, Ltd., in Montreal. Here is just a bit from a letter of his that I saw last week:

> "Here is the whole thing in a nutshel: Mr. Roth has a most remarkable Memory Course. It is simple, and easy as falling off a log. Yet with one hour a day of practice, anyone—I don't care who he is—can improve his Memory 100 per cent in a week and 1,000 per cent in six months."

My advice to you is don't wait another minute. Send to Independent Corporation for Mr. Roth's amazing course and see what a wonderful memory you have got. Your dividends in *increased power* will be enormous.

VICTOR JONES.

"*Of Course* I Place You! Mr. Addison Sims of Seattle"

While Mr. Jones has chosen the story form for this account of his experience and that of others with the Roth Memory Course, he has used only facts that are known personally to the President of the Independent Corporation, who hereby verifies the accuracy of Mr. Jones' story in all particulars.

Send No Money

So confident is the Independent Corporation, the publishers of the Roth Memory Course, that once you have an opportunity to see in your own home how easy it is to double, yes triple, your memory power in a few short hours, that they are willing to send the course on free examinations.

Don't send any money. Merely mail the coupon or write a letter and the complete course will be sent, all charges prepaid, at once. If you are not entirely satisfied send it back any time within five days after you receive it and you will owe nothing.

On the other hand, if you are as pleased as are the thousands of other men and women who have used the course, send only $5 in full payment. You take no risk and you have everything to gain, so mail the coupon now before this remarkable offer is withdrawn.

FREE EXAMINATION COUPON

Independent Corporation

Publishers of the Independent Weekly

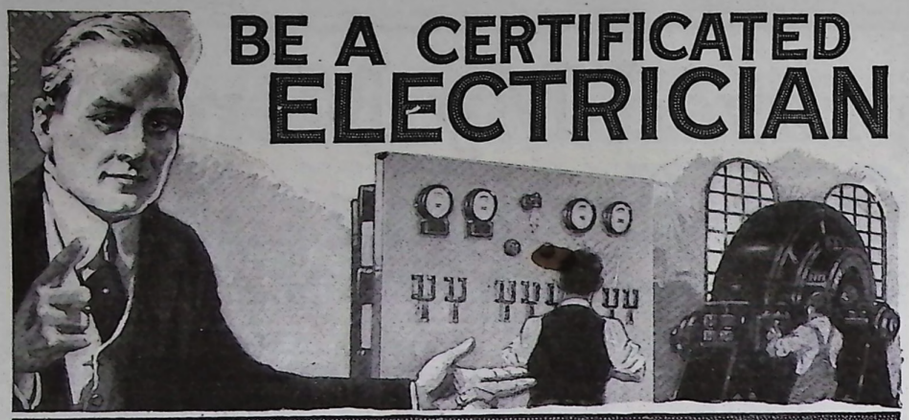
Dept. R-773, 119 West 40th Street, New York

Please send me the Roth Memory Course of seven lessons. I will either remail the course to you within five days after its receipt or send you $5 in full payment of the course.

Name .....

Address .....

..... Pop. Science Mo.—3-20



Prepare NOW, and be ready in a few months to earn your

$60 to $150 A WEEK

The country needs thousands of trained, Certified Electricians to fill good positions—and at big pay. It's all a matter of knowing how, and I will teach you by up-to-date, modern instruction. You can learn at home, without interfering with your regular work, by my highly successful method of **Home Instruction** in **Practical Electricity.**

A Real Position Like This—for YOU

Send for this Book—

My book, **"HOW TO BECOME AN EXPERT ELECTRICIAN,"** has started thousands of young men on the way to splendid success. A new edition of this has just been printed. I want every young man interested in Electricity to have a copy, and send you one, ABSOLUTELY FREE AND PREPAID. Write me today.

How I Train My Students

As Chief Engineer of the Chicago Engineering Works I know exactly the kind of training a man needs to enable him to get and hold good positions, and to earn big pay. I have trained hundreds of men who are holding splendid electrical jobs.

I give each of my students personal attention and a complete and thorough training. I give him a SPLENDID ELECTRICAL OUTFIT FREE, and much of the training is done by actual work. When my students graduate and receive their certificate they are ready for a real position. But **still more,** at any time you wish you can come to our splendidly equipped Electrical Shops for special training. No other school can give you this.

A Real Opportunity for YOU

Wishing is never going to make your dreams come true. You've got to **study—to learn.** A man is worth only $2 or $3 a day from his neck down—and no more; but there is **no limit** to what he can be worth from his neck up.

A **trained mind** is what gets the big pay. It is this training that you need, and I can train you in a few months. Are you ambitious to make a real success—then send me the coupon—today.

Electrical Outfit Free

To every student who answers this ad I am giving a splendid Electrical Outfit of standard size Electrical Tools, Instruments, Materials, etc., **absolutely free.** Furthermore, to every Electrical Student I give a truly **valuable** surprise that I cannot explain here.

Free Employment Service

I am continually receiving requests from employers to send them trained Electrical men. I assist my students to secure good positions. I keep in touch with them for years, helping and advising them in every possible way.

Write Now—Don't Delay

Delay never got you anything. Action is what counts. Get started—and get started now. Write me, or send me the coupon, right NOW.

L. L. COOKE, *Chief Engineer*

CHICAGO ENGINEERING WORKS

DEPT. 33

441 Cass Street : : : : : CHICAGO

USE THIS "FREE OUTFIT" COUPON

Chief Eng. Cooke,
Dept. 33
441 Cass St., Chicago, Ill.
Sir: Send at once—fully prepaid and entirely free—complete particulars of your great offer for this month.

Name .....

Address.....

City.....State.....

YOU CAN DO IT

CONTENTS—*Continued*

Page

MEDICINE AND SURGERY

Wire Your Bathrobe and Keep Well 27
When It's Clean-Up Day in Poland 40
Cultivating Cooties for Scientific Reason 63
This Clock Calls Nurse and Medicine 66
Learning to Walk All Over Again 89
Helping the Blind to "See" Color 89

MOTOR VEHICLES AND ACCESSORIES

To Remove Flywheels 34
Making Repairs Without Getting Under 34
The One-Man Ford Top Is Here 34
At Home Even on the Links 35
New Tractor-Trailer Connection 35
Getting Rid of Grease on the Automobile 35
In Emergency Use Wayside Telephone 60
Things New in the World of Motors 64
Tanks in the Sight-Seeing Business 67
Things Done with Gasoline Engine Exhaust 72
Your Own Gasoline Station 86

NATURAL SCIENCE

Watch Out for Willow Roots 41
A Giant Snail and Her Egg 63
The Life Story of a Double Calf 86
Bent but Not Broken by the Wild Wind 87

PICTORIAL PAGES

How to Earn a Living 30
Noise for the Silent Drama 31
These Are the Real Money-Makers 42
Prohibitionists and "Antis" Take Notice 43
Want to Be a Movie Star, Fido? 52
The Gum that Gertie Chews 70
Put Out of the Race by a Pirate of the Air 71
Do It with Tools and Machinery 78
Inventions to Help the Housewife 79

SPORTS AND PASTIMES

Lighting Up the Tight-Rope Walker 32
The Bicycle Gets Its Emergency Brake 40
Women Jockies Come Next 46
The Banjo of a Thousand Pieces 46
Why Not Sharpen Your Own Skates? 48
Bats Made of Wood Strips and Glue 49
Stove Opens Up Like an Umbrella 49
Tuck a Piano Under Your Arm 50
He Put a Rudder on His Sled 75
A Trap-Door for Cards 75
I'll Shoot You a Game of Pool 75
The Limousine of the Bicycle World 87

MISCELLANY

Advertisement on a Water-Wheel 27
Fighting Fire Under Water 28
Where's the Collar Button? 32
Rope Shoes Made by a Sailor 33
Better Keep Bees 33
A Lit-Up Policeman 33
Nature in Wax, Glass, and Plaster 36
Soya Beans to the Rescue 36
The Diamond and Its Bloody Story 37
How They Cross the Street in Cincinnati 40
A War-Dance on a Block of Jade 41
It's Called a "Mechanical Impertinence" 41
Grow Your Own Molasses 41
Signaling on a Keyboard 44
War on the Jack-Rabbits 44
Inviting Guests with Bricks 46
A Room Designed to Attract Aviators 46
He Pedals as He Peddles 46
Tread-Wheel Irrigates the Fields 47
Selling to the Man Higher Up 47
It Was Here Before Columbus 47
The Ladder Step Walks with You 47
No Smuggling on the Rhine 47
Put a Burglar Alarm on Your Baby 49
Turns Two Faces to the World 49
How Will You Have Your Gas? 50
Toy-Makers in Santa's Work-Shop 54
Should Home Look Like This? 54
One of the Great Unknowns 55
Announcing Mr. Burglar 56
Can You Name the Seven Seas? 56
Shop-Lifting Up to Date 56
Whale Ho —There She Blows 57
Visiting the Fish Without Getting Wet 58
Something for Your Empty Bottle 58
Perfect Broiled Hamburger 58
An Electrical Cabinet for the Class-Room 59
Five Centuries Old Type 60

(*Continued on page 6*)

New Oliver Typewriters

At About Half Price

Latest Model
Number Nine

Was $100
Now $57

FREE TRIAL—
No Money Down
Over a Year to Pay

Save $43

By This New Plan—Be Your Own Salesman

The Guarantee of a $2,000,000 Concern
That This $57 Typewriter Was $100

During the war we learned that it was unnecessary to have great numbers of travelling salesmen and numerous, expensive branch houses throughout the country. We were also able to discontinue many other superfluous, costly sales methods. You benefit by these savings. The $57 Oliver is the identical machine that was formerly $100. Not one change has been made in design or materials. Each machine is a new Oliver—our latest and finest product.

The $100 Model

The Oliver Nine is the finest, the costliest, the most successful model we ever built. If any typewriter is worth $100, it is this handsome machine, the greatest Oliver triumph.

Over 800,000 have been sold. This is the same commercial machine used by the U. S. Steel Corporation, the Standard Oil Company, the National City Bank of New York, Montgomery Ward & Co., the Pennsylvania Railroad, and a host of others. Any operator can use the Oliver.

Free Trial; No Money Down

Here is our plan: We ship an Oliver Nine to you for five days free trial. No money down—no C.O.D. Use it in your office or at home. Try it—without anyone to influence you.

If you want to keep it, send us $3 per month.

If you want to send it back, we even refund the out-going transportation charges.

That is the entire plan. You are the sole judge. At no time during the trial are you under the slightest obligation to buy. Superiority and economy alone must convince you.

Amazing Facts

We have just published a startling book, entitled "The High Cost of Typewriters—The Reason and the Remedy," which reveals the inside history of the typewriter world—old customs of selling—secrets never before divulged—all about price inflation—subsidies, etc. All the follies of $100 pricing are exposed. Readers are astounded.

Mail the coupon now. You will be surprised.

This book tells everything. With it we send our catalogue, free trial order blanks, etc. After reading it, you may order a free-trial Oliver.

Canadian Price, $72

The Oliver Typewriter Company 97.02
1103 Oliver Typewriter Bldg., Chicago, Ill.

FREE BOOK

THE OLIVER TYPEWRITER CO.,
1103 Oliver Typewriter Bldg., Chicago, Ill.

☐ Ship me a new Oliver Nine for five days free inspection. If I keep it, I will pay $57 at the rate of $3 per month. The title to remain in you until fully paid for.

My shipping point is _____

This does not place me under any obligation to buy. If I choose to return the Oliver, I will ship it back at your expense at the end of five days.

☐ Do not send a machine until I order it. Mail me your book—"The High Cost of Typewriters—The Reason and the Remedy," your de luxe catalog and further information.

Name _____

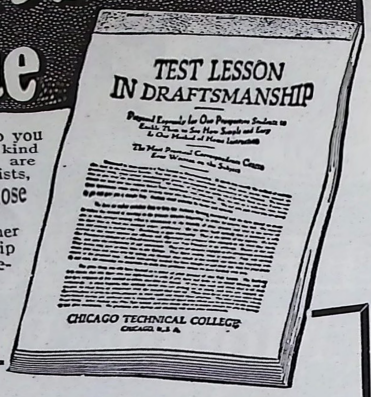
Street Address _____

City _____ State _____

Occupation or Business _____

Be a Draftsman

Raise Your Income



Get into this paying profession and have positions opened to you by manufacturers, architects, railroads, contractors—by every kind of a corporation where mechanical design and construction are carried out. Draftsmanship puts you in the class of specialists, raises you above the crowd of job hunters, makes you a man whose services are needed.

You have the same opportunity to get the training that other men had who took the Chicago "Tech" Course in Draftsmanship and are now drawing large salaries and holding important, responsible positions. You also can learn how to earn

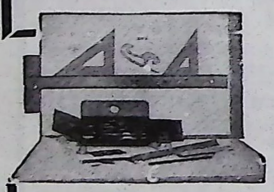
$25 to $100 a Week—or More

Not enough really skilled draftsmen are available to fill the places open now. All you need is training to be prepared to answer the call that will mean more money for you. Begin your training without delay. Don't waste time waiting. The Chicago "Tech" experts are ready today to give you the thorough, practical instruction which will enable you to step into the drafting room of some big organization prepared to do the kind of work that earns high salaries and leads to advancement. At least write. Mail the coupon below or a letter stating which branch specially interests you.

Come to Chicago "Tech" or

TRAIN AT HOME

Chicago "Tech" has its students everywhere. If you can't come to Chicago, take the Home Study course. The same professors who direct the resident courses will teach you by mail. You will have their personal direction, you will learn the most modern methods—all this while holding your present job. We train hundreds of ambitious men—and see them quickly rise to success. You therefore need not be denied this technical education. Sign and mail the coupon.



Drawing Outfit

(No Extra Charge)

Every student of the Chicago "Tech" Home Study Course in Draftsmanship receives this drawing outfit—set of instruments in case, drawing board, T square, triangles, scale, curve, drawing paper, pencils, etc., or a cash credit in case he already has an outfit. You use them while learning—then take them right into your practical work.

FREE

Test Lesson

Other institutions ask you to pay first—and then to find out later how well qualified you are for this profession. We send the free lesson first and place you under no obligation at all. Discover your qualifications before you pay anything. And see for yourself just what Chicago "Tech" offers you in training which will bring a ready market for your services and open opportunities which are closed to the untrained man. The coupon will bring all the facts about the course, the small fee, and the easy terms.

Easy Payments

Low tuition fees and *easy terms of payment.* Pay as you go along. Get training which will soon repay in extra earnings all the cost of course. You know the salaries received by skilled technical men. Get information on the opportunities which are opened wide to you by Chicago "Tech."

Practical Training Under Practical Men
No Time Put In On Needless Studies

Enrollment with Chicago "Tech" means getting direct personal instruction from men who for years have planned and directed big architectural and engineering work in leading cities. They have weeded out useless theories and needless studies and will give you the kind of instruction which will enable you to work beside the most experienced men.

That is one reason why you can get a complete, thorough technical training here in such a short time. Also the reason why Chicago "Tech" men are in such great demand. They go into work prepared to give the kind of service wanted.

This is the training you are offered either at the college or by mail. And this is the time to enroll when there is such a pressing need for highly trained draftsmen. Use your spare hours to fit yourself for a bigger salary—a more important position. Chicago "Tech" offers you the opportunity.

Send the Coupon

Below we list our principal courses in Drafting and several others. Just mark X in the ☐ to show which course interests you and we will send catalog and information about that particular subject. If in doubt about yourself, tell us your ambitions and we will advise you. Sending this coupon may mark a turning point in your career. May lead to a larger measure of success than you have expected. We can train you as we have trained others. Send the coupon to-day.

Auto and Gas Engine Course

All about automobile mechanism—its construction, operation and REPAIRS—taught by mail. You train directly under the Chicago "Tech" automobile experts. Learn all about Principles of the Automobile, all about Gas Engines, Power Plants, Transmissions, Lubrication, Cooling, Batteries, Starting and Lighting Systems, etc.

Know How to Fix Troubles

Most complete instruction in auto repair work. Equips you for high pay or to start a business. Big demand for trained repair men.

Aeronautics

Complete, practical instruction in Aeronautic Engineering. Every principle made clear. Construction of every type of machine fully explained. This course equips you for expert work. Get the catalog and information. Send coupon.

CHICAGO TECHNICAL COLLEGE
331 Chicago "Tech" Building, Chicago

Without obligation upon me, send your Catalog on subject indicated below. Also FREE Lesson **if inquiry is on Drafting or Plan Reading.**

Mark X opposite work in which you are especially interested.

- ☐ Architectural Drafting
- ☐ Machine Drafting
- ☐ Electrical Drafting
- ☐ Structural Drafting
- ☐ Sheet Metal Drafting
- ☐ Builders' Course
- ☐ Plan-Reading—Building
- ☐ Plan-Reading—Shop Men
- ☐ Estimating
- ☐ Surveying
- ☐ **Autos and Gas Engine**
- ☐ **Aeronautics**

Name ----------

Address ----------

City ---------- State ----------

College or Home Study? State which. ----------

CONTENTS—*Continued*

	Page
Why Models Won't Work When Enlarged	61
A New Reason for a Clean Face	62
Around the World in a Minute	63
Bread Flowers for Sale Here	66
A Sailboat that Can't Sink	66
A Train Helps Out an Airplane	66
Cleaning Out the Hornets' Nest	66
Cutting Down Electric Light Bills	67
The Drum that Wears a Wound Stripe	68
Advocating Pedestals for Students	68
Making a Monkey of the Photographer	68
Where the Office Seeks the Man	74
Tearing Down the Victory Arch	74
A Movie Star of the Future?	74
Enough Cheese for a Lifetime	74
Gid-dap There, Llama	75
No Females on This Holy Mountain	75
Josephine the Joy-Rider	75
Once They Would Have Burned Him at the Stake	77
Ripples of Life and Waves of Death	81
Ready to Battle with the Deep	84
A Fence that Was Founded in Barrels	86
General Pershing Carved in Soap	86
Billiards on a Cigar-Holder	87
A Building Lit Up in Shape of a Cross	87
Drinking at the Fire Hydrant	87
A Wooden Bed-Spring	88
Seventy Miles an Hour on the Water	90

RADIO-TELEGRAPHY AND TELEPHONY

A Simple, Undamped-Wave Receiving Set	132
Clearing Up the Radio Patent Situation	132
A World-Wide Experiment in Radio Transmission	132
Switch from Valve to Crystal	133
Know the Electron	134

PRACTICAL WORKERS

What You Can Do with an Old House	91
See Your Phonograph Records at Night	92
How to Make All the Clocks Strike at Once	94
How to Handle Electrical Circuits in Safety	94
An Inexpensively Made Chemical-Mixer	96
Make a Medicine-Dropper from the Stopper	96
Folding Handles for the Tool-Box	98
Adapting a Gasoline Engine to Burn Kerosene	98
A Soiled Waste Receptacle	98
Apparatus for Slotting Instrument Bases	100
A Double Punch for Washers	100
A Flexible Filing Envelope	102
To Separate Boiled Eggs from Raw Ones	104
The Hairpin as Calipers	104
Cleaner-Cans as Nail-Containers	104
Pipe Brackets Support Wagon Boards	106
Towing a Disabled Car Without Injury	106
Stand Up to Scrub Floors	108
Old Automobile Makes Portable Machine-Shop	108
A Quick Road Repair	110
Manufacture Your Own Perfumes	112
Why Trade in Your Old Automobile?	112
Things I Made to Reduce the H. C. L.	114
A Homemade Cold-Box	116
Hints About Tire Mileage	116
Doubling the Capacity of Your Clothes-Closet	118
Jack Up the Gate	120
The Care of D. C. and A. C. Motors	121
A Leveling Trestle for Machine Work	122
Make an Adjustable Swing Churn	122
Bore Difficult Holes with Long Shank-Drill	123
Flanging a Copper Tube	124
Oil-Pump from Old Tire-Pump	124
A Refrigerator that Needs No Ice	125
Repairing a Steam Engine Under Difficulties	127
To Work on the Under Side of a Car	127
How to Retread an Automobile Tire	128
A Drill-Press and How to Make It	130
Why Your Radiator Boils	131
How to Locate Instantly a Particular Drill	137
It Rivals the Weather Bureau	139
Difficult Electric Installation	140
Use the Furnace for Cooking	140
Save Money with This Tire Code	141
Boat-Pump Bails When Boat Moves	142
For the Amateur Carpenter	142
Ice-Water Tank that Keeps Cool	143
A Ladle Made from a Bell-Gong	143
A Screw-Eye for Your Key-Ring	144
How to Eliminate Sparking at the Brushes	144
A Magic Clock for Home Entertainment	145
A Machine that Polishes Silverware	146
Wash Bottle for Test-Tube Cleaning	147
Piping Water to the Curb	148
A Tooth-Brush Makes a Good Pen-Cleaner	149
How to Make a Card Dissolve	149
Every Knock Is a Boost	150
A Cover for the Medicine-Glass	151
Keep the Engine Clean	152
How to Turn Accurate Gage Pieces	153
A One-Man Sack-Filling Contrivance	153
Wire Swing Will Last for Years	154
An Automatic Drinking-Cup for Poultry	154
How to Install a Cable on an Elevator	155
Electric Furnace for Laboratory	156
Separating Water from Oil by Filtration	158

Shave a New Way

—Easier, Quicker, Pleasanter

Then Compare It With the Old Way

Facts such as these convince the home shaver that harsh, slow ways are no longer necessary. Shavaid, the new, soothing beard-softener, replaces annoying and harmful operations, saves time, gives new delight. To learn its merit, send for a Free Trial Tube.

HERE is a new satisfying way to gain a comfort shave. A way now being adopted by men the nation over.

This welcome offering is Shavaid. It is a scientific preparation, perfected after countless experiments and tests.

It revolutionizes home shaving. It turns an irksome task into a refreshing pleasure. Once you try it you will never give it up.

It Saves All This

Shavaid saves hot water applications. It saves rubbing the lather in. It saves waiting for the beard to soften. It saves doctoring an irritated skin with lotion afterwards. It means a quick shave, an easy shave, a luxury shave. It avoids discomforts in a close shave. It does instantly what old shaving methods never could do at all.

If all this is so, you want it. You will never shave without it. No man abuses his face willingly.

Old vs. New

Simply coat the dry beard thinly with Shavaid, before applying lather. Note the cooling, soothing effect.

Note how the lather remains moist and creamy.

Shavaid

Softens the beard instantly
—apply to dry face before the lather.

Saves time and trouble
—no hot water, no "rubbing in" of the lather.

Protects the face
—skin remains firm and smooth.

Removes the razor "pull"
—harsh ways age the skin prematurely.

Replaces after-lotions
—Shavaid is a cooling, soothing balm.

This way is quicker. Yet it protects the skin. Harsh treatments bring wrinkles too soon.

Hot water applications make the face tender and bring the blood to the surface. That causes abrasions.

With Shavaid, you can obtain a close shave without irritation. The Shavaid way keeps the skin firm and smooth.

The razor glides over easily.

And best of all, no lotions are necessary afterwards, for Shavaid is in itself a cooling, soothing, healing emollient. Its daily use keeps the cuticle in condition.

See If You Agree

We realize in introducing such an innovation that the quickest way for it to win its rightful popularity, is to hasten its use by as many men as possible.

So we offer here, via coupon, a Free Trial Tube. It contains sufficient Shavaid for a convincing test.

After using this Trial Tube, and agreeing that you do not want to be without it, you can then buy Shavaid from your druggist at 50c. a tube.

If your dealer cannot supply Shavaid we will be pleased to furnish it direct.

B&B

Shavaid

At Druggists—50c. a Tube

BAUER & BLACK, Chicago, New York, Toronto

Makers of Sterile Surgical Dressings and Allied Products

58

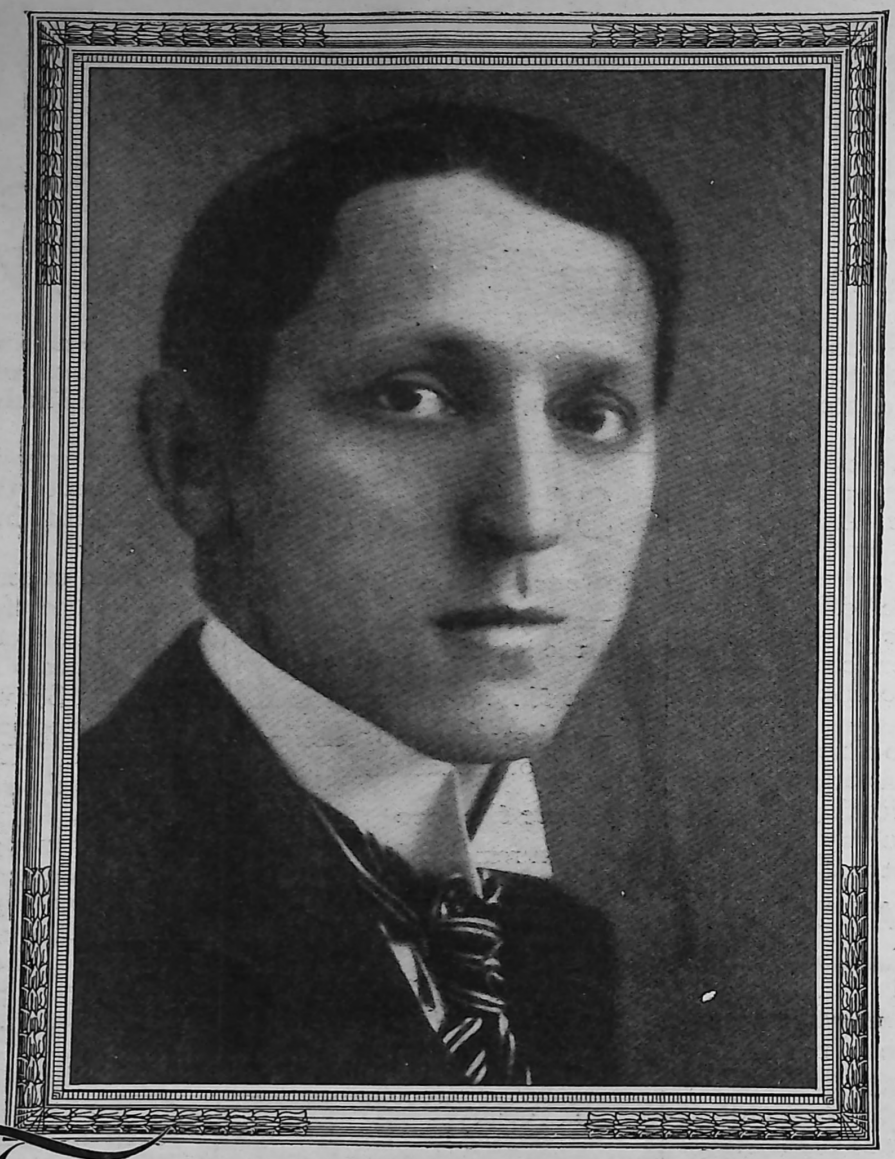
BAUER & BLACK, Chicago, Ill.

Mail free tube of Shavaid to

Name.....

Street Address.....

City..... *State*.....



Free Proof That I Can Raise Your Pay

No matter how much you are earning now, I can show you how to increase it. I have even taken failures and shown them how to make $100—$200, and in one case as high as $2,000 weekly. I am willing to prove this entirely at my risk and expense.

LET'S have a little chat about getting ahead—you and I. My name is Pelton. Lots of people call me "The Man Who Makes Men Rich." I don't deny it. I've done it for thousands of people—lifted them up from poverty to riches.

I'm no genius—far from it. I'm just a plain, everyday, unassuming sort of man. I know what poverty is. I've looked black despair in the eye—had failure stalk me around and hoodoo everything I did. I've known the bitterest kind of want.

But to-day all is different. I have money and all the things that money will buy. I am rich also in the things that money won't buy—health, happiness and friendship. Few people have more of the blessings of the world than I.

IT was a simple thing that jumped me up from poverty to riches. As I've said, I'm no genius. But I had the good fortune to know a genius. One day this man told me a "secret." It had to do with getting ahead and growing rich. He had used it himself with remarkable results. He said that every wealthy man knew this "secret,"—that is why he was rich.

I used the "secret." It surely had a good test. At that time I was flat broke. Worse than that, for I was several thousand dollars in the hole. I had about given up hope when I put the "secret" to work.

At first I couldn't believe my sudden change in fortune. Money actually flowed in on me. I was thrilled with a new sense of power. Things I couldn't do before became as easy for me to do as opening a door. My business boomed and continued to leap ahead at a rate that startled me. Prosperity became my partner. Since that day I've never known what it is

to want for money, friendship, happiness, health or any of the good things of life.

That "secret" surely made me rich in every sense of the word.

MY sudden rise to riches naturally surprised others. One by one people came to me and asked me how I did it. I told them. And it worked for them as well as it did for me.

Some of the things this "secret" has done for people are astounding. I would hardly believe them if I hadn't seen them with my own eyes. Adding ten, twenty, thirty or forty dollars a week to a man's income is a mere nothing. That's merely playing at it. In one case I took a rank failure and in a few weeks had him earning as high as $2,000.00 a week. Listen to this:

A young man in the East had an article for which there was a nation-wide demand. For twelve years he "puttered round" with it, barely eking out a living. Today this young man is worth $200,000. He is building a $25,000 home—and paying cash for it. He has three automobiles. His children go to private schools. He goes hunting, fishing, traveling whenever the mood strikes him. His income is over a thousand dollars a week.

In a little town in New York lives a man who two years ago was pitied by all who knew him. From the time he was 14 he had worked and slaved—and at sixty he was looked upon as a failure. Without work—in debt to his charitable friends, with an invalid son to support, the outlook was pitchy black.

Then he learned the "secret." In two weeks he was in business for himself. In three months his plant was working night and day to fill orders. During 1916 the profits were $20,000. During 1917 the profits ran close to $40,000. And this genial 64-year-young man in enjoying the pleasures and comforts he little dreamed would ever be his.

I COULD tell you thousands of similar instances. But there's no need to do this, as I'm willing to tell you the "secret" itself. Then you can put it to work and see what it will do for you.

I don't claim I can make you rich over night. Maybe I can—maybe I can't. Sometimes I have failures—everyone has. But I do claim that I can help 90 out of every 100 people if they will let me.

The only point of it all, my friend, is that you are using only about one-tenth of that wonderful brain of yours. That's why you haven't won greater success. Throw the unused nine-tenths of your brain into action and you'll be amazed at the almost instantaneous results.

The Will is the motive power of the brain. Without a highly trained, inflexible will, a man has about as much chance of attaining success in life as a railway engine has of crossing the continent without steam. The biggest ideas have no value without will-power to "put them over." Yet the will, although heretofore entirely neglected, can be trained into wonderful power like the brain or memory and by the very same method—intelligent exercise and use.

If you held your arm in a sling for two years, it would become powerless to lift a feather from lack of use. The same is true of the Will—it becomes useless from lack of practice. Because we don't use our Wills—because we continually bow to circumstance—we become unable to assert ourselves. What our wills need is practice.

Develop your will-power and money will flow in on you. Rich opportunities will open up for you. Driving energy you never dreamed you had will manifest itself. You will thrill with a new power—a power that nothing can resist. You'll have an influence over people that you never thought possible. Success—in whatever form you want it—will come as easy as failure came before. And those are only a few of the things the "secret" will do for you. The "secret" is fully explained in the wonderful book "Power of Will."

A FEW EXAMPLES

Personal Experiences

AMONG over 350,000 users of "Power of Will" are such men as Judge Ben B. Lindsey; Supreme Court Justice Parker; Wu Ting Fang, Ex. U. S. Chinese Ambassador; Assistant Postmaster General Britt; Lieut. Gov. McKelvie of Nebraska; General Manager Christeson of Wells-Fargo Express Co.; E. St. Elmo Lewis, former Vice-Pres. Art Metal Construction Co.; Gov. Ferris of Michigan, and many others of equal prominence.

$300 Profit from One Day's Reading

"The result from one day's study netted me $300 cash. I think it a great book and would not be without it for ten times the cost."—A. W. Wilkie, Faulkton, So. Dakota.

Worth $15,000 and More

"The book has been worth more than $15,000 to me."—Oscar B. Sheppard, 1117 E. Locust St., Decatur, Ill.

Would Be Worth $100,000

"If I had only had it when I was 20 years old, I would be worth $100,000 today. It is worth a hundred times the price."—S. W. Taylor, The Sante Fe Ry., Milans, Tex.

Salary Jumped from $150 to $800

"Since I read Power of Will my salary has jumped from $150 to $800 a month."—J. F. Gibson, San Diego, Cal.

From $100 to $3,000 a Month

"One of our boys who read Power of Will before he came over here jumped from $100 a month to $3,000 the first month, and won a $250 prize for the best salesmanship in the State."—Private Leslie A. Still, A. E. F. France

How You Can Prove This at My Expense

I KNOW you'll think that I've claimed a lot. Perhaps you think there must be a catch somewhere. But here is my offer. You can easily make thousands—you can't lose a penny.

Send no money—no, not a cent. Merely clip the coupon and mail it to me. By return mail you'll receive not a pamphlet, but the whole "secret" told in this wonderful book, "POWER OF WILL."

Keep it five days. Look it over in your home. Apply some of its simple teachings. If it doesn't show you how you can increase your income many times over—just as it has for thousands of others—mail the book back. You will be out nothing.

But if you do not feel that "POWER OF WILL" will do for you what it has done for over a quarter of a million others—if you feel as they do that it's the next greatest book to the Bible—send me only $3.50 and you and I'll be square.

If you pass this offer by, I'll be out only the small profit on a three-and-a-half dollar sale. But you—you may easily be out the difference between what you're making now and an income several times as great. So you see you've a lot—a whole lot—more to lose than I.

Mail the coupon or write a letter now—you may never read this offer again.

PELTON PUBLISHING CO.
14F Wilcox Block, Meriden, Conn.

PELTON PUBLISHING COMPANY
14F Wilcox Block, Meriden, Conn.

You may send me "Power of Will" at your risk. I agree to remit $3.50 or remail the book to you in five days.

Name.....

Address..... Pop. Sci. 3-20

QUICK-ACTION ADVERTISING

HERE READERS AND ADVERTISERS MEET TO TRANSACT BUSINESS

Rate 25 Cents a Word, no discounts. Advertisements for the May issue should be received by March 1st.

AUTOMOBILES AND ACCESSORIES

7,000 MILES from $7.00 tire. Record of John Rockwood, Avoca, Iowa. Save 74%. Use our serviceable, double fabric tires. They are practically puncture proof and guaranteed 5,000 miles: 30x3, $7.00; 30x3½, $7.50; 32x3½, $8.50; 31x4, $9.00; 32x4, $9.50; 33x4, $10.00; 34x4, $10.50; 35x4½, $12.00; 36x4½, $12.50; 37x5, $14.00. Other sizes in stock. Straight side or clincher non-skid or plain. Terms 5% discount, cash or check with order. Direct factory shipment from $100,000.00 stock same day order received. Order at once before prices increase. Rubber Trading Company, No. 614-35 South Dearborn Street, Chicago.

PORTABLE Garages, wood or steel, reasonable prices. Bona Fide Building Mfrs., 22 Borden Avenue, Long Island City.

HYDRONIZER: Insures clean plugs, consumes carbon, saves gasoline, intensifies power and increases speed. For all cars. Money back guarantee. Big profits for agents. Free literature. Friestedt Manufacturing Company, 2933 West Lake Street, Chicago.

MORE Power, less fuel, no carbon. No mystery, plain facts, results guaranteed. Write for booklet. No-Leak-O Piston Ring Company, Baltimore, Maryland.

PATENTS.—Write for Free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch and description of invention for our opinion of its patentable nature. Highest references. Reasonable terms. Victor J. Evans & Company, 189 Ninth. Washington, D. C.

AUTO Motor Supplies. Buick, Michigan, Stoddard Dayton, Hupp 32, Cadillac, Overland, E. M. F., Continental and Buda Motors, all types, $50 each and up. Special high tension Bosch Magnetos, $15 each and up. Prest-O-Lite 2 and 4 cylinder magnetos, $9.50 each. Generators, starters, etc. Write for Bargain Bulletin. Second hand auto accessories. Address Motor Sales, Dept. 14, West End, Pittsburgh, Pennsylvania.

ENORMOUS demand; Sell Tankii; Modern auto-fuel, 100 to 200% profit.—"Vapor-Spray" system burns water. Adds tremendous power. Tankii, Cleveland, Ohio.

INSYDE Tyres, inner armor for automobile tires, double mileage and prevents punctures and blowouts. Quickly applied. Cost little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. F3, Cincinnati, Ohio.

AUTOMOBILE Parts for all cars—50% off manufacturers' list price. Pistons, connecting rods, cam shafts, crank shafts, cylinders, axles and gears. Our new catalogue and Used Parts Bulletin now ready. Write for it to-day. Service and satisfaction guaranteed. Auto Parts Company, 4108 Olive Street, St. Louis, Missouri.

TIRES. Factory-to-You Prices. Exclusive representative wanted each locality to use and sell Mellinger Extra Ply Tires. Guarantee Bond 8000 Miles. Sample sections furnished. Mellinger Tire Company, 937 Oak Street, Kansas City, Missouri.

VULCANIZING auto tires is a growing and profitable business. Easy to learn. Instruction book, $1. Plants $50 to $300. Details free. Equipment Co., 17 Canal, Cincinnati, Ohio.

TIRES at Wholesale. Send for prices on 7,500 mile guaranteed tires and tubes. We have the cheapest high-grade, long life and reliable tires in the world. No "seconds" or rebuilt tires. Overton Rubber Company, Oelwein, Iowa.

INSYDE Tyres, inner armor for Automobile Tires, prevents punctures and double mileages of any tires. Liberal profits. Details free. American Accessories Co., Dept. 97-A, Cincinnati, Ohio.

BATTERY Charging pays big profits. City currents or gas engine operates. Easy terms. Hobarts, Troy, Ohio.

RED DEVIL Auto Polish—Brightens the way. Regular 60c. can, 50c to introduce. Agents wanted. Red Devil Products, Dept. 1, Farmingdale, New York.

SAVE money! Make money! Work for yourself or for others. Know about auto construction and repairs. Illustrated catalog and new instructive books sent free. Dept. B-6, Automobile Digest, Cincinnati, Ohio.

FORD ACCESSORIES

FORDS start easy in cold weather. Will run 34 miles per gallon on cheapest gasoline or half kerosene using our 1920 carburetors. Increased power styles for all motors, can attach them yourself. Big profits to agents; money back guarantee; 30 days' trial; Air Friction Carburetor Company, 500 Madison Street, Dayton, Ohio.

FORD Fan Grease Guard—Prevents grease and oil splashing interior of hood, frame or motor; fits any Ford model; put on in a minute. Fifty cents postpaid—or from your dealer or jobber. Agents wanted. American Valve Tool Mfg. Company, 354 West 50th Street, New York.

MOTOR Tire Pump for Fords. Can be made by any Ford owner from discarded parts. Serviceable and efficient. A Handy labor and time saver. Full instructions and drawings mailed, $1.50 (no stamps). Stoeckle Company, Box A117, Bellmore, New York.

PISTON Rings, Timers, Valve Lifters, Adjustable Valves, etc., just what you will require when overhauling your Ford. Write for our money saving circular at once. S. & C. Company, P. O. Box 678, Meriden, Connecticut.

ARE you interested in Automobile construction, repairing, etc? Send for FREE illustrated catalogue of new instructive books. Department B-2, Automobile Digest, Cincinnati, O.

FORDS double the mileage with Picard Carburetors. Easiest starting carburetor made. Double the power. Satisfaction guaranteed. Free trial. Agents wanted. York Sales Company, Dept. PS, 1518 East Jefferson Avenue, Detroit, Michigan.

TIMER Brush. New wiping contact; quick starting; easiest running. Only 34 cents, prepaid. R. Sp. Works, Box 543, Riverside, California.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

ELECTRICAL

BLUEPRINTS—Electrical connections. 236 A. C. motor, single, two and three phase. Voltage, cycle, phase changing. 123 D. C. Voltage changing, etc. 120 transformer connections. 150 rheostats, controllers, compensators, internal and external. 10 samples A. C., 25c. Particulars free. Charles Chittenden, Dept. S, 3024 Matthews Avenue, Kansas City, Missouri.

ELECTRICIANS, Wiremen, Linemen, send your name and address for descriptive literature of our Modern Blue Print Chart Method of Electrical Wiring. Over 350 practical diagrams. Electrical Wiring Diagram Company, Box B173, Altoona, Pennsylvania.

SELENIUM CELLS—We are manufacturers of high class Selenium Cells, highly sensitive and quick acting; also relays to be used in conjunction therewith. Suitable for all experiments, from $2 up. Write for Catalogue. Selenium Laboratories, Good Ground, New York.

ILLUSTRATED catalog just issued. Generators, motors, sockets, wire switches, porcelain material. Hyre Electric Company, 629 PD South Dearborn Street, Chicago.

MAKE Dry Batteries. Simple, practical instructions, with blue print, 25 cents. Dirigo Sales Company, Bath, Maine.

Sometimes They Leave Us

Now and then we receive the kind of letter that no publisher likes to get—a cancellation. For when a magazine has built up a worthwhile section of high-class advertisers, it regrets to see any one withdraw for any reason. But when the CAUSE is explained as follows, there's a natural sense of gratification felt by all concerned:

"Our advertisement has given such splendid results that, owing to our stock being depleted through orders received from Popular Science Monthly, it will be necessary to cancel our notice until you hear from us further."

CHARLES E. TUCKER & SON.

"The business received from Popular Science Monthly greatly exceeded our expectations and the stock that we had in hand was quickly exhausted."

DIRIGO SALES COMPANY.

"It certainly was not because of insufficient orders that we cancelled our advertisement, but because we received so many replies that we were unable to give them proper attention."

EDGEWOOD STAMP COMPANY.

It will only cost YOU 25 Cents a Word to talk to this vast audience of BUYERS. Why don't you?

Classified Advertising Manager
POPULAR SCIENCE MONTHLY
225 West 39th Street
New York City

TRADE SCHOOLS

HILES' Watchmaking and Engraving School, the largest and best equipped school in the West. 717 Market Street, San Francisco, California.

EARN $40 to $100 weekly. Learn paperhanging, decorating, sign, scenic and auto painting, showcard writing, graining. Catalogue free. Chicago Painting Schools, 133 North Wells Street, Chicago.

BOATS AND LAUNCHES

DARROW'S Steel Boats. Finished parts for patterns. Catalogue, 78 models. F. H. Darrow, 604 Erie Street, Albion, Michigan.

WIRELESS

EXPERIMENTAL Wireless Stations—Bargain Price. For boys just beginning radio this is an excellent book. The spark systems and crystal-receiver apparatus described are adequate for anyone who wishes to start out in the radio field. Complete instructions for sending and receiving apparatus are included. To dispose of a few remaining copies of the old edition, the price is 75c. The new edition is $2.00. Book Department, Popular Science Monthly, 225 West 39th Street, New York City.

SIMPLE Wireless Telephones and How to Make Them. A good book for the advanced radio amateur on the principles, construction and use of the wireless telephone. Price 25 cents postpaid. Book Dept., Popular Science Monthly, 225 West 39th Street, New York.

MOTORCYCLES, BICYCLES, SUPPLIES

MOTORCYCLES all makes, $25.00 up. New bicycles at big reduction. Second hand, $8.00 up. Motors, motor attachments. Cycle motors. Smith motor wheels, etc., $20.00 up. New parts to fit all makes carried in stock. Second hand parts good as new 50% discount. Expert repairing, on magnetos, generators, transmissions. Motors overhauled $10.00 up. Henderson motors our specialty. Write for big bargain bulletin. American Motor Cycle Company, Dept. 3, Chicago.

REBUILT motorcycles at half cost of new machines. Write for Bargain Bulletin. Western Supplies Company, 371 Hayutin Building, Denver, Colorado.

$25.00 Up—Guaranteed rebuilt motorcycles—Henderson, Excelsior, Indian, Harley-Davidson. Bicycles, $5.00 up. Tires and accessories at wholesale. Illustrated bulletin "A" free. Ash Motor Corporation, 162 North Clinton Avenue, Rochester, New York.

MOTORCYCLES—Buy now while prices are low. Large stock on hand. Harleys, Indians, Excelsior, Henderson, Popes, Reading-Standards and others. Tires and tubes at big reductions; state size wanted. Machines all overhauled and guaranteed running condition. Illustrated catalogue "F." Carl W. Bush Company, Newark, New Jersey.

MANUFACTURING

WE do Metal Stamping, Die and Model Work, Gold, Silver, Nickel, Copper and Brass Plating; also special finishes. We will manufacture your article either on straight time or contract basis. When our tool or model maker is on your job, you are welcome at his bench. Denning Manufacturing Company, 1775-1777 East 87th Street, Cleveland, Ohio.

TO Order: Any article in metal; models, tools, patterns, experimenting, manufacturing. Inventions developed. Cleveland Specialty and Manufacturing Company, Cleveland, Ohio.

AVIATION

THE American School of Aviation announces a new correspondence course in Mechanics of Aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 1863, 461 South Dearborn Street, Chicago.

AIRPLANES—1 to 6 passenger; aeronautical motors 30 to 300 H.P. Lowest prices. State your needs. Send for lists "P. S." Aero Exchange, 38 Park Row, New York.

THAT unassembled Ford or motorcycle airplane now ready, complete literature of either, 2c stamp. Latest motor or propeller catalogue. 4c each. Thousands of Government test standard turnbuckles at ½ less than factory cost. Heath Airplane Company, Chicago.

INVENTORS desiring information write for our Free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch of invention for our opinion of its patentable nature. Highest references. Prompt service. Reasonable terms. Victor J. Evans & Company, 151 Ninth, Washington, D. C.

THE Aerocar—Aviation type speedster, developed along aeroplane lines and driven by an aeroplane propeller. As easily operated as a bicycle and capable of high speed. Parts inexpensive. Send 50c for construction plans. Aerocar Company, Racine, Wisconsin.

WELDING AND SOLDERING

DON'T scrap aluminum parts! Save them, with So-Luminum. New, great "3-in-1" welding, brazing and soldering compound, stronger than aluminum—perfect substitute for acetylene welding—½ time and cost. Use gasoline torch or soldering iron. No flux. Booklet g. Sample bar $1.00. Used by United States Army and Navy, indorsed by British Munitions Board. So-Luminum Manufacturing Company, 1790 Broadway, New York.

WELDING PLANTS, $25.00 to $300.00. Designed for all purposes. Small cash payment, balance three to six months. Every mechanic or shop should have one. Bermo Welding Co., Omaha, U. S. A.

WANTED

WE pay the highest prices for diamonds, platinum, watches, old or broken jewelry, old gold, silver, magneto points, old false teeth, gold or silver ores or nuggets, War Bonds and Stamps. Mail them to us today. Cash by return mail. Goods returned in 10 days if you're not satisfied. The Ohio Smelting & Refining Company, 238 Lennox Building, Cleveland, Ohio.

WANTED—Representatives in every Factory in the United States. Popular Science Monthly, 225 West 39th Street, New York.

CASH for Old False Teeth. We pay up to $35.00 per set (broken or not). Also buy discarded gold jewelry, gold crowns, bridges, platinum, diamonds, watches and silver. Send now. Cash by return mail. Package held 5 to 10 days for senders' approval of our offer. U. S. Smelting Works, Dept. 81, Chicago, Illinois.

WANTED—Small gasoline and steam engines. Drill presses, lathes, electric motors, etc. Will pay high cash prices for good material. Johnston, West End, Pittsburgh, Pennsylvania.

KEY DUPLICATING MACHINES

DUPLICATE keys for all Yale and similar locks made in one minute with Harrison Key Filing Machine. No misfits. Thousands in use. Sent prepaid $5.00. Money returned if not satisfactory. Harrison & Company, 83 New Street, New York.

DUPLICATING DEVICES

"MODERN" Duplicator—a Business Getter, $1.50 up. 50 to 75 copies from pen, pencil, typewriter; no glue or gelatine. 35,000 firms use it. 30 days' trial. You need one. Booklet Free. J. V. Durkin & Reeves Company, Pittsburgh, Pennsylvania.

MOTORS, ENGINES, MACHINERY

SMALL Motors and Generators. Cancelled Government Contracts A. C. Motors $9.50 each and up. 12 Light 110 volt Generators $26.50 each, Battery Charging outfits $30 each and up. New Motors ¼-½ up to 5 HP for all phases and frequencies of current. Write for late Bulletin. Bargains in Motors and Generators. Address: Motor Sales, Dept. 14, West End, Pittsburgh, Pennsylvania.

ILLUSTRATED catalog just issued. Generators, motors, sockets, wire, switches, porcelain material. Hyre Electric Co., 629 MT South Dearborn St., Chicago.

BLUEPRINTS: Small Steam Engines and Boilers, 13 Sheets). Gasoline Engines, ¼-½ H. P., (3 Sets, Postpaid $1.00. Circular on Castings for Stamp. Universal Gas Motor Co., 304 Monadnock Block, Chicago.

500 heavy duty ¼ H. P. motors. General Electric and other standard makes; 110 volt, 60 cycle single phase, guaranteed perfect, $18.00 Brand new, never unpacked, $18.00 and $22.00. Pennsylvania Motor Exchange, Lancaster, Pennsylvania.

FOR THE HOME

GRANDFATHER'S Clock Works $5.00. Build your own cases from our free instructions. Everybody wants a hall clock. You can make good profit building artistic clocks for your friends. We replace worn-out works in old clocks with works having chimes at money saving prices. Write for folder describing the most beautiful hall clock ever sold at $25.00. Clock Co., Nicetown, Pennsylvania.

RADIUM Lokators—Guaranteed to shine in the dark. Attach to electric switches, gas jets, key holes, etc. 1,000 Radium other uses. Send 25c. Agents 100% profit. Products Company, 712 Monroe Place, West New York, New Jersey.

FOR BOYS

BOYS—Receive wireless apparatus free. Send for information. Beck Novelty House, 1298 Carroll Street, Brooklyn, New York.

FOR SALE AND EXCHANGE

GUARANTEED: "Titan" Roof Paint; heavy bodied, waterproof, fireproof. Limited period 60c gallon-barrels; Waxol Dustproof Wood Floor Oil $1.00 gallon; Wizard Leak Repair Waterproof Mastic Cement $1.00. Martinek Company, 405 Lexington Avenue, New York.

CHOICE Silver Black Breeding Foxes—Siberian Hares—Western Ontario Farm Lands. Reid Brothers, Bothwell, Ontario.

LET'S SWAP! What've you got? What d'ye want? Free advertising. Three months and big mail dime. Swap Bulletin, "The National Exchange Medium," Detroit.

LABORATORY AND CHEMICAL SERVICE

MICROSCOPES, Balances, Experimental Laboratories. Buy through our easy payment plan. No red tape. Ask for Booklets 24-S. Lions Scientific Institute, Bausman Street, Mt. Oliver, Pittsburgh, Pennsylvania.

FORMULAS

IF You Are Marketing Auto Specialties and plan upon extending your line, or contemplate entering this field, we can supply dependable formulae at $1.00 each for such products as Auto body Polish, Autoist's Hand Paste, Moisture Preventative for Windshields, Auto Lubricating Oil, Puncture Closing Compound, Anti-Freeze Preparation and Non-inflammable Metal Polish. Sources of supply included with each formula. Industrial Methods Bureau, 1B West 34th Street, New York.

500 Successful money-making formulas and trade secrets. Postpaid 25c. Charles Dynes, Winchester, Indiana.

1,000 Moneymaking Formulas only 25c. "Ideal," 5501-PS. North Robey, Chicago.

500 Formulas, all easy, successful money-makers. Postpaid 25c. Edgar James, 315 Douglass, Indianapolis, Indiana.

FORMULA for making storage battery plates, $1 postpaid. H. Deckelman, 7118 Nashville Avenue, St. Louis, Missouri.

PROFITABLE money-making processes. Details of manufacture accompanying each formula. Send for list. F. N. Biordslee, 1368 Broadway, New York.

GUARANTEED vanilla flavoring formula, 20c (silver). Al. Tytler, Monterey, California.

AUTOMOBILE Body and Metal Polish Combination. Easily made and sold on demonstration. Formula 50c. Abramson and Plummer, Aurora, Illinois.

OFFICE AND FACTORY EQUIPMENT

MULTIGRAPHS—Addressographs, Multicolors, Duplicators, Folders, Sealers, Typewriters, Dictaphones, Check Protectors. Office Device Company, 22 North Wabash, Chicago.

TYPEWRITERS AND SUPPLIES

NEW, remanufactured and slightly used Typewriters $8.00 up. Portable Machines $10 up. Write for our Catalog 25C. Beran Typewriter Company, 58 West Washington Street, Chicago.

ADDING MACHINES

WONDERFUL Adding Machine, seven columns capacity, only one dollar. Adds and multiplies as fast as the fingers will move. Thousands being sold through demonstration. L. J. Leishman Company, Dept. L. Ogden, Utah.

WORTH its price for inventory alone. Marvelous new Automatic Adding Machine. Retails $12.50. Work equals $300 machine. Five-year guarantee. Write for trial offer. Calculator Corporation, Dept. P, Grand Rapids, Michigan.

DIAMONDS, WATCHES, JEWELRY

SOFT Shirt Links and "No Fuss" connection; quality guaranteed. Complete in gift box, 52c; War Tax, 3c. The Cut Rate Jewelers, Scranton, Pennsylvania.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classined Advertising, Popula. Science Monthly, 225 West 39th Street, New York.

SPORTING GOODS

"JULIAN'S Liquid Fishing Lure"—Whole winter's supply, one dollar. George Julian, Albany Building, Boston, Massachusetts.

PRINTING, ENGRAVING, MULTIGRAPHING

GOOD Printing at low prices. 1,000 good letterheads, envelopes, cards, billheads, labels, circulars, $2.50; samples free; catalogues, booklets and circulars our specialty. Ernest F. Fantus Co., 523 S. Dearborn St., Chicago, Ill.

MULTIGRAPH Letters build business. Most economical and effective advertising. Printing. Addressing. Low rates; careful work; service. Multigraph Peerless Letter Company, 241 Fourth Avenue, New York.

ACTUAL Typewritten Letters, heading black, body purple, 100, $1.50; 500, $2.50; 1,000, $4.00; 5,000, $13.00. Artus Letter Shop, 409 Chestnut Street, Milwaukee, Wisconsin.

5000 Gummed Labels, $1.50. Catalog. Irwin Wolf, Station E, Philadelphia.

FREE catalog of ideas in labels that will benefit your business. Royal Label Company, 27 South Seventh, Philadelphia.

1,000 Newmarket Bond Letterheads, $2.35 postpaid. Echo Printery, Wauwatosa, Wisconsin.

100 Cards, business, professional or social, also imitation leather card case, for 60 cents. M. F. Devaney. Printing, Engraving, Rubber Stamps, 31 Middle Street, Geneva, New York.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classined Advertising, Popular Science Monthly, 225 West 39th Street, New York.

LETTERHEADS $2 thousand. Samples free. Quality Print Shop, Marietta, Ohio.

100 VISITING or Business Cards, 75c; Book-form Card Case Free. Federal Printing Company, Baltimore, Maryland.

DRAWINGS and cuts of mechanical devices, general advertising designs and illustrations. Moderate prices. Prompt service. F. E. Brown, 1377 Palm Terrace, Pasadena, California.

GUMMED Labels! Interesting Samples Free! Edward Harrison, "Attractive Printing," Baltimore.

BUSINESS Cards and Envelopes printed. 100 calling cards, 40c; case free. Paul Rogers, Chesapeake, Ohio.

TYPEWRITTEN letters reproduced; letterheads, etc. Specimens sent. Peerless Letter Service, Aurora, Illinois.

250 BOND LETTERHEADS, and Envelopes, $2.25. Other printing, lowest prices. Samples, 4c. B. F. Ball and Company, Dept. 26A, Buckland, Connecticut.

ADVERTISING SERVICE

LETTERS that land orders. Advertisements, circulars, booklets written. Tell your problem fully in first letter. Criterion Service, Dept. A-3, West New York, New Jersey. "Our Business is Building Business."

ADVERTISE for great results. Your 30 word ad. in The West Virginia Advertiser, one year, $2.00. E. J. Evans, Publisher, 729 6th Avenue, Huntington, West Virginia.

SPECIAL! 1000 co-publishers wanted. Sample Particulars—Registration, $1. Globe Syndicate, Atlantic City.

24 WORDS in 100 Syndicate Magazines, $1.00 inch display, $4.00. Lists free. Stanford Service, Pittsburgh.

SPECIAL! Inch Display Advertisement, 150 Magazines thrice, $10. Page, thrice, $150. Sample 20c. Wood's Popular Advertising Service, Atlantic City.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, would'nt you? Manager Classined Advertising, Popular Science Monthly, 225 West 39th Street, New York.

MISCELLANEOUS

ELECTRICAL Tattooing Machine, $3, $5, and $7. Catalogue for stamps. J. H. Temke, 1019 Vine, Psm., Cincinnati, Ohio.

QUESTIONS Answered. All subjects. Send for Circular 2. Answerall Information Bureau, 51 Cliff Street, New York.

BALDNESS. Indian's recipe for growing hair; astonishing success. Proof box mailed for 10 cents. John Hart Brittain, 150 East 32d Street, BA-188, New York.

CANDY

CHERI Super Chocolates, assorted, pound box $1.25, parcel post prepaid, insured. Best you ever tasted at any price or the box with our compliments. Cheri, Inc., 142 South 15th Street, Philadelphia.

FOREIGN LANGUAGE STUDY

LEARN Spanish Easily at Home or Here. 16 years experience enables us to teach you in the shortest time to read, write and speak correctly. Commercial translating. Native instructors. Prunera Studios of Spanish, 180 Broadway, New York City.

ROOTS, HERBS, PLANTS

GINSENG—$10,000 made from one-half acre; easily grown in Northern U. S. and Canada. Full printed instructions and 200 seeds for planting sent postpaid, only 40c. Medical Plant Company, West Milan, New Hampshire.

MAILING LISTS

5,000 different classifications, 1919-1920. Largely $2.00 per thousand addresses. Rightquick Publicity Bureau, 1314 Arch Street, Philadelphia, Pennsylvania. Established 1907.

DOGS, BIRDS, PETS

SPORTSMEN—Trained beagles, rabbit, fox, coon, skunk, squirrel and opossum dogs, bird dogs, pet and farm dogs, swine, rabbits, pigeons, pheasants, goats. 100 Varieties blooded stock. Circulars 10c. Violet Hill Kennels, York, Pennsylvania.

BREED Canaries—Profitable pastime. Particulars free. Bird Farm, Lynnhaven, Virginia.

AUCTIONEERS

AUCTIONEERS—Make big money. Free catalogue. Carpenter's Auction School, Kansas City.

PHOTOGRAPHY AND SUPPLIES

Mail us 15c with any size film for development and six velvet prints. Or send six negatives any size and 15c for six prints. Or send 35c for one 8x10 mounted enlargement. Prompt, perfect service. Roanoke Photo Finishing Co., 212 Bell Avenue, Roanoke, Virginia.

FILMS developed 5c roll, prints 3c each. Photo Service, 929 McMillan, Cincinnati, Ohio.

DO you take pictures? Send one thin dime for our big magazines showing how to take better pictures and earn money. American Photography, 156 Pope Building, Boston, Massachusetts.

CAMERAS—Films, supplies, at reduced prices. Films developed 2c, prints 2c up. Write for free catalog. Pearl Photo Place, 640 East Clementine Street, Philadelphia, Pennsylvania.

SOMETHING different! Polished silvertone prints; six, 20c.; send roll or negatives. "Silvertone," 950-A Lockwood, Chicago.

MOTION PICTURE BUSINESS

MAKE money fast—small capital starts you with guaranteed professional moving picture machine. Complete outfit on easy payments. No experience needed. Catalogue free. Dept. S, Monarch Theatre Supply Service, 420 Market Street, St. Louis, Missouri.

MOVIE Cameras $60; tripods $5; home projector $40; 200 feet films $2. Ray, 326 Fifth Avenue, New York.

$35.00 profit nightly! Small capital starts you. No experience needed. Our machines are used and endorsed by government institutions. Catalog Free. Atlas Moving Picture Co., 441 Morton Building, Chicago.

WRITE Photoplays; $50 each. Experience unnecessary; details free to beginners. Producers' League, 194, St. Louis.

PHOTOPLAYS Wanted. Big prices paid. You can write them. We show you how. Free particulars. Rex Publishers, Box 175, P 99, Chicago.

COMPLETE Moving Picture Outfit professional machine film screens, chairs, light plant. Easy payments Large catalog free. Monarch Film Service, Dept. 27, 228 Union Avenue, Memphis, Tennessee.

MAKE money fast: start "Movie" Theatre with small capital. Buy complete outfit on easy payments. Openings everywhere. No experience required. Catalog free. National Moving Picture Company, Dept. P. E., Ellsworth Building, Chicago.

WRITE Photoplays. Make money at home, $50 to $100 each. Great demand. Experience unnecessary. Particulars free. E. Cumbo, 1915 South Kedzie, Chicago.

LEARN how to write photo plays. My book tells how, where to send, gives model, for 50c. Lester deFrates, Box 1461, Boston.

AUTHORS—MANUSCRIPTS

FREE to writers—A wonderful little book of money-making hints, suggestions, ideas; the A B C of successful story and play-writing. Absolutely Free. Just address: Authors' Press, Dept. 15, Auburn, New York.

MANUSCRIPTS Typewritten—Correctly arranged and punctuated. Neatness, promptness. Criterion Service, Dept. A3, West New York, New Jersey.

$50 to $150 a week Writing Stories. Previous acceptance not essential. Send for Special Free Offer. Department 33, New York Literary Bureau, 145 West 36th Street, New York City.

WRITE for newspapers and magazines. Big Pay. Experience unnecessary, details free. Press Reporting Syndicate, 400, St. Louis.

WRITERS! Have you a song-poem, story, photoplay, to sell? Submit manuscript now to Music Sales Company, 48, St. Louis.

WRITERS: Stories, poems, plays, etc., are wanted for publication. Literary Bureau, 117, Hannibal, Missouri.

LITERARY

SPEECHES, essays, pamphlets and special articles prepared for all occasions. 500 word, $5. Gertrude Sanborn, 778 Farwell Avenue, Milwaukee, Wisconsin.

AMERICAN MADE TOYS

AMERICAN Made Toys Wanted. An opportunity for homeworkers on small scale and manufacturers on large scale. Unlimited quantities needed of Toy Soldiers, Army, Navy, Marines, Cannons, Machine Guns, War-ships and other Toys and Novelties. Greatest chance for industrious people for independent business. Enormous demand and future in American Made Toys, all over United States, Canada, Mexico and South America with over 50,000 ten-cent stores and toy dealers. This new American industry stands out conspicuously. Factories are established, people trained, machineries made. Christmas Sets needed in millions this year. The great hit for 1919 without any competition. We are buyers of these goods all year, paying fixed prices. Attractive prices offered for painted goods. Experiences or tools unnecessary. Hundreds and more made complete per hour. Casting form outfits from $3 up. If you mean business, send for booklet and information free. Toy Soldier Manufacturing Company, 32 Union Square, New York.

FISH, AQUARIUMS, SUPPLIES

GOLDFISH—Imported Japanese, Chinese and American fish; aquarium plants, artistic, durable aquariums. Catalogue. Pioneer Goldfish Hatchery No. 5, Racine Wisconsin.

POULTRY

POULTRY Paper. 50c year; 3 years $1.00. Sample 25c; with paper, 65c. Poultry Advocate, Dept. A-98, Syracuse, New York.

STAMMERING

STAMMERING cured—quickly, permanently, and privately. Write for free booklet. Samuel E. Robbins, 246 Huntington Avenue, Boston, Massachusetts.

ST-TUT-T-T-TERING and Stammering cured at home Instructive booklet free. Walter McDonnell, 59 Potomac Bank Building, Washington, D. C.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classined Advertising, Popular Science Monthly, 225 West 39th Street, New York.

EDUCATIONAL AND INSTRUCTION

SHORTHAND Made Easy by "the greatest living authority on Shorthand," Oliver McEwan, author of McEwan's easy shorthand, declared by experts to be "the simplest, the briefest and most legible ever devised." Now being studied by over 500 superintendents of schools, high school and business school principals. 1000 teachers wanted. Practically free training. McEwan Shorthand Corporation, 72 West Adams Street, Chicago.

LINCOLN-JEFFERSON University. Home study in college. Theology, Law, Music. Business and Graduate schools. Usual degrees granted. Lock Box 239G, Chicago.

TYPEHAND shorthand. Wonderful new shorthand system. Learnt in 10 minutes. Simple, easy, sure. Price $1.00. Particulars free. Winslow P. Chase, Washington, D. C.

PARAGON Shorthand. System learned in 7 days. Used in U. S. Government, in court reporting, in largest corporations, in public schools. Full details in circulars. Paragon Institute, 66 Coliseum Place, New Orleans, Louisiana.

SALESMANSHIP wins. We instruct by mail and guarantee offer of position or refund tuition. Kansas Vocational Bureau, Miltonvale, Kansas.

CARTOONING, Comics and Lettering in fourteen easy lessons. Only $5 postpaid. Sample lesson, 25c. Ernie's School, Elyria, Ohio

YOUR advertisement in this space would put you in immediate touch with nearly a million buyers—people who know what they want and who have the money to purchase it. The 400 other advertisers in this section are getting direct, profitable and continuous results at low cost. If you want to know what they think of Popular Science Monthly, write D. W. Coutlee, 225 West 39th Street, New York.

FOR MEN AND WOMEN

MY-T-FINE Scalp Cleaner. A new hair wash. Perfect dandruff eradicator. Cleans the scalp, strengthens the roots, preserves the hair. Absolutely harmless. 25c postpaid. Agents wanted. My-T-Fine Scalp Cleaner, 564 Central Avenue, Brooklyn, New York.

GENUINE Indian Baskets—Wholesale. Catalogue. Gilham, Highland Springs, California.

"SEXUAL Philosophy," 12c. Clear, specific, authoritative, complete, best satisfies. Fred B. Kaessmann, Lawrence, Mass.

GET Ahead! Gain in individuality and power! Success studygram, and personality sketch for 10c and birthdate. Thomson-Heywood Company, S9 Chronicle Building, San Francisco.

CIGARETTE Smokers, attention! Newest patent pocket cigarette roller, rolls any tobacco. Sent on receipt of 40 cents coin. Perfection Cigarette Roller Company, Box 35, Station J, Brooklyn, New York.

MAKE $19.00 Hundred Stamping Names on Key checks. Send 25c for sample and instructions. PS Keytag Company, Cohoes, New York.

STOP falling hair! Stop itching scalp! Send $1.00 and I will tell you something to apply to your scalp, twice a week, that will dissolve and quickly eradicate every particle of dandruff and stop falling hair. No tonic). Pure and simple. Wm. Foster, Expert on Scalp Treatment, 3901 Grand Boulevard, Chicago, Illinois.

OIL-PROOF Caps—"Can be washed in oil." Made from tan or black leatherette in latest style. Non-breakable peaks, $2.00. Zuckerman, 204 West 23rd Street, New York, New York.

PYORRHEA—Bleeding or swollen gums: "Pyorem," a successful home treatment. Purifying, healing, preventative. Full month's treatment, $1.00; or write for free booklet. Pyorem Mfg. Company, 439 Seventh Street, Brooklyn, New York.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Mo.

GET vital strength! Retain youthful vigor. Wonderful results. Intensely interesting booklet free. Winslow E. Chase, Washington, D. C.

"HEALTH-CULTURE"—insures vital force, youthful vigor, strength and beauty, 25c. "Natural Laws Governing Success"—158 pages, $1.00. Five dozen "Money Makers," 30c. Professor Anderson, PM1336 Morse, Chicago.

DETECTIVES—Great demand, excellent opportunity. Experience unnecessary. Write American Detective System, 1968 Broadway, New York.

"THE Road to Recognition." A delightfully written little book brimful of inspiration. Just the thing to inspire a young man to better effort. Price postpaid $1.00. Book Department, Popular Science Monthly, No. 225 West 39th Street, New York.

SHAMPU-TABS: Three Suddy Shampoos, 15c.; 2 for 25c. Tab Products, Dept. I, Farmingdale, New York.

BIBLE Against Prohibition. Proved. Argument settler. Every quotation. 20c; description, 3c. Torch Publishing Company, Maryland Bank Building, Baltimore, Maryland.

GAMES AND ENTERTAINMENT

PLAYS, vaudeville acts, monologs, dialogs, recitations, pageants, musical readings, special entertainments, tableaux, drills, minstrel jokes, make-up goods. Large Catalog Free. T. S. Denison & Company, Dept. 26, Chicago.

1,000 Stage tricks with 500 illustrations. Catalogue 15c, small catalogue free. Hornmann Magic Company, 304 West 34th Street, New York.

TRICKS and Greenbacks. Big magic catalog 5c. Twenty greenbacks—10c. Gilmagico, 11135 South Irving, Chicago.

CRYSTAL Gazing—the craze: send self-addressed stamped envelope for free instructions. Zancigs Studio, Asbury Park, New Jersey.

AGENTS—My Wholesale Joke Catalogue Free. Mears, 66, Anderson, Indiana.

250 MAGIC tricks and catalog, 10c. Clarence Maugan, Anderson, Indiana.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

REAL ESTATE—FARM LANDS

IS this your idea of Florida? A little piece of land near the water, a boat, a garden, some strawberry plants, and perhaps a few chickens; a vine-covered cottage among your own orange and grapefruit trees; fish and oysters in abundance; plenty of quail and game—a simple, natural, wholesome life in the open the year round—home, health, and contentment. All this is within your reach at modest outlay in this beautiful land of sunshine and roses. We are on the Gulf and a navigable river; also on the Dixie Highway. Here we have the freedom, comfort and economy of country life, yet are only two hours by motor bus from big cities and resort centers like Tampa and St. Petersburg, and we are only eight miles from Tarpon Springs. Our community is new and prices have not gone sky-high; living expenses are moderate. Over 100 Northern families already here. They like it—perhaps you will. May we send complete information? Board of Trade, Box 603, New Port Richey, Florida.

MONEY-MAKING Farms—17 States—$10 to $100 acre. Stock, tools, crops often included to settle quickly. Write for big illustrated catalogue. E. A. Strout Farm Agency, 2026 BH, Sun Building, New York.

FREE Book of Florida Facts. If interested in Florida, before visiting or settling in this wonderful state of fragrant flowers and sunshine, write Lake County Land Owners' Association, No. 205 Lloyd Street, Fruitland Park, Florida, for free book of actual photographs and real conservative facts concerning this state. There is poor, good, better and best land in Florida. This book will teach you what is best and why. The members of the Association are not land agents; they simply wish to tell actual facts to those really interested in the state. They have no time to waste on curiosity seekers, children or people who expect to grow rich without effort, but to those of character, energy, some capital, with a desire to learn more of the opportunities in this most prosperous state we would be glad to give fullest information.

SHAWNEE, Oklahoma. A live city. Questions cheerfully answered. Board of Commerce, Shawnee, Oklahoma.

"ELECTRIC Light for the Farm." The object of this book is to give practical information on small low voltage electric light plants, suitable for farms, isolated houses, stores and country homes in general. Price postpaid, $1.00. Book Department, Popular Science Monthly, No. 225 West 39th Street, New York.

MUSIC AND SHEET MUSIC

SONG Writers: You cannot afford to miss our proposition. Reference, any bank or first-class sheet music house. Warner C. Williams & Company, Dept. S, Indianapolis, Indiana.

AL PIANTADOSI Company, Music Publishers, 232 West 46th Street, New York City, for popularizing purposes, offer their latest waltz song, "Egyptian Nights," 30c seller, and eleven other choice song hits, postpaid, for $1.00.

WRITE the words for a song. We write music, guarantee publisher's acceptance. Submit poems on patriotism, love or any subject. Chester Music Company, 920 South Michigan Avenue, Room 111, Chicago.

WRITE the words for a song. We revise poems, write music and guarantee to secure publication. Submit poems on any subject. Broadway Studios, 121C Fitzgerald Building, New York.

WRITE a Song—Love, mother, home, childhood, patriotic or any subject. I compose music and guarantee publication. Send words to-day. Thomas Merlin, 238 Reaper Block, Chicago.

YOU write words for a song—we write the music, publish, and secure a copyright. Submit poems on any subject. The Metropolitan Studios, 914 South Michigan Avenue, Room 106, Chicago, Illinois.

SONG-WRITERS' Manual and Guide Sent Free! Contains valuable instructions and advice. Submit song-poems for examination. We will furnish music, copyright and facilitate publication or sale. Knickerbocker Studios, 315 Gaiety Building, New York.

HAVE you song poems? I have best proposition. Ray Hibbeler, D-1, 4040 Dickens Avenue, Chicago.

MUSICAL INSTRUMENTS

CORNETISTS—Trombonists: "Free Pointers" on weak lip—high tones. Virtuoso Cornet School, Buffalo, New York.

PHONOGRAPHS, RECORDS, NEEDLES

BUILD your own phonograph. Big saving. Pleasant, instructive work. Complete instructions, blue-prints, etc., absolutely free. Write to-day. Associated Phonograph Company, Dept. F1, Cincinnati, Ohio.

BUILD your Phonograph. "Perfection" high quality spring and electric Motors. Tone Arms, Reproducers. Wonderful results. Big saving. New catalog and building instructions mailed for ten cents. Indiana Phonograph Supply Co., Indianapolis, Indiana.

PICTURES AND POSTCARDS

TEN Wonderful Snapshots with explanatory booklet of my experiences in the South Sea Islands, Philippines and China Sea. They are gems for any album. Price, $1.00 Money refunded if not delighted. J. C. Jeffries, 710 East Saturn Street, Huntington Park, California.

JOIN Live Postcard Club. Membership Papers 10c. Harvey Teeple, Decatur, Indiana.

WAR Atrocities in Belgium. Heroes in battles, and ruins. 200 different post card views. Particulars free. Belgian Specialty House, 2806 Union Avenue, Chicago, Illinois.

EVERYTHING in postcards. Up-to-date lists free. Worth-while samples 25c. Mention subjects preferred. Mutual Supply Company, Publishers, Bradford, Pennsylvania.

"HANDY Atlas of the World." Separate maps of the various states of the United States, all the continents and countries of the world. 74 pages of maps with valuable statistical data. Price postpaid $1.00. Book Department, Popular Science Monthly, No. 225 West 39th Street, New York.

LIKE real Photographs. State wants. Send stamp. Art Studio, 826 Calhoun, Fort Wayne, Indiana.

PATENTS FOR SALE

SOMETHING new! Patent for sale for the best Adjustable Automatic Dimmer in existence. Nothing like it on the market. Ask for details today. Charles Machacek, Jr., P. O. Route No. 2, Tabor, South Dakota.

SAFETY device for mine cages or elevators. Great merit. Outright or royalty. Write Louis Pichler, 1580 East 18th Street, Cleveland, Ohio.

WE have a few practical money-making inventions for sale or trade. Adam Fisher Mfg. Co., 183B, St. Louis, Missouri.

FOR INVENTORS

900 Mechanical Movements, also illustrations explaining 50 Perpetual Motions. My book, Inventor's Universal Educator, Fifth Edition, tells how to procure and sell patents. Government and other costs. Covers the matter from A to Z. 160 pages elegantly bound. Contains noted decisions of U. S. Supreme and State Courts on Patent Cases. Mechanical Movements greatly assist inventors—suggest new ideas that may prove of great aid in perfecting inventions. Tells how to select an Attorney. Has valuable information regarding Patent Sharks, Selling Agents and Brokers Price $2. Postage Free everywhere. Fred G. Dieterich, 681 Ouray Building, Washington, D. C.

PATENTS.—Write for free Guide Book and Evidence of Conception Blank. Send model or sketch of invention for free opinion of its patentable nature. Highest references. Reasonable terms. Victor J. Evans & Company, 156 Ninth, Washington, D. C.

HAVE you a practical invention to sell outright or place on royalty? Send details to Adam Fisher Mfg. Co., 183 A, St. Louis, Missouri.

PATENTS—My fee payable in monthly instalments. Send sketch for advice. Booklet free. Frank Fuller, Washington, D. C.

INVENTOR'S Adviser Free; gives valuable information and advice. Write F. Ledermann, 15 Park Row, New York.

INVENTORS: We make models, dies, tools. 28 years' experience; work guaranteed; lowest price. Manufacture of specialties our hobby. Peerless Die & Tool Company, 121 Opera Place, Cincinnati, Ohio.

INVENTORS—Sell your ideas of patents through National Institute of Inventors, 118 Fulton, New York City. Membership 2,500. We help you secure, develop and finance your inventions. Annual dues $10.

INVENTIONS Wanted! If you have the right invention and can protect same to suit our attorney it will be pushed throughout the country; excellent prospects for inventions to be patented. 706 Park Building, Worcester, Massachusetts.

ELECTRICIAN'S Wiring Manual, by F. E. Sengstock, E. E., contains all the essential information needed for the proper installation of lighting and power systems in houses and other buildings. This manual is written in simple, plain English by an Electrical Engineer with many years' experience on the Chicago Board of Underwriters. Profusely illustrated and contains many tables and formulas. New edition out November 1st. Pocket size, flexible binding, 448 pages. Price, $2.50 postpaid. Book Department, Popular Science Monthly, 225 West 39th Street, New York City.

EXPERT Technical Sales Service for Inventors. Information free. L. M. Geibel, 26 Cheltenham Drive, Buffalo, New York.

STAMPS AND COINS

NEVER Sell Old Coins until you see our Copyrighted 6x9 Illustrated Coin Value Book (New Edition)—showing high prices we pay. $100.00 paid for 1894 dime, S Mint. Send 10c for your copy to-day. You may have valuable coins. International Coin Co., Box 151-M, Philadelphia, Pennsylvania.

CALIFORNIA gold, quarter size, 27c; $½ size, 53c. White cent and catalogue 10c. Norman Shultz, King City, Missouri.

100 Different Stamps, 10c; 200, 25c. Approvals. Michaels, 5600 Prairie, Chicago.

STAMPS—61 different, also interesting Lists free. Postage 2c. Payn Stamp Company, 138 North Wellington Street, Los Angeles, California.

50 Excellent stamps—8c. Roessilers' Stamp News, year 25c—Merit approvals—60% discount. 5 French Colonies Free. Postage 2c. Edwin Bailey, Farmingdale, New York.

158 Genuine Foreign Stamps—Mexico War Issues Venezuela, Salvador and India Service. Guatemala, China, etc., only 10c. Finest Approval Sheets 50% to 60%. Agents wanted. Big 72-p. Lists Free. We buy stamps. Established 25 years. Hussman Stamp Company, Dept. 55, St. Louis, Missouri.

300 Different Stamps, 50c. Fred Onken, 630 79th Street, Brooklyn, New York.

STAMPS, 61 All Different, 3 cents. Mention paper. Quaker Stamp Co., Toledo, Ohio.

$2 to $600 paid for hundreds of old coins dated before 1895. Send 10 cents at once for new illustrated coin value book. Size 4x7. It may mean your fortune. Clarke & Co., Coin Dealers, Box 76, LeRoy, N. Y.

PACKET "A" 100 varieties foreign stamps, 20c. F. J. Pope, Charlotte, Vermont.

17 Varieties Hayti Stamps 20c. List of 7000 varieties low priced stamps free. Chambers Stamp Co., 111C, Nassau Street, New York City.

STAMPS—50 varieties, Transvaal, Brazil, Peru, Cuba, Mexico, etc., and Album 10c. 50 different U. S., 25c. 1,000 hinges, 10c. 1,000 mixed 40c. List free. I buy stamps. C. Stegman, 5949 Cote Brilliante, St. Louis, Missouri.

CALIFORNIA gold, quarter size and Columbia Nickel, 30c. Villa coin and catalog, 10c. Homer Schultz, Union Star, Missouri.

STAMPS—50 different British Guiana, China, Jamaica, Portugal, Venezuela, etc., 10c; 1,000 all different, fine collection in itself, $5.00; 100 various U. S. 50c; 1,000 hinges, 10c; agents wanted, 50 per cent. List free. I buy stamps. L. B. Dover, Overland, Missouri.

BEST one cent approvals in America. F. P. Hall, 1117 South 60th Street, Philadelphia, Pennsylvania.

STAMPS—12 different from warring nations, 10c; 10 different foreign coins, 25c; 10 Uruguay stamps for 10c. Lists free. Toledo Stamp Company, Toledo, Ohio.

FREE! 25 different British Colonials to applicants for approvals. Postage 2c. Nickles, 122 Florida Avenue, Washington, D. C.

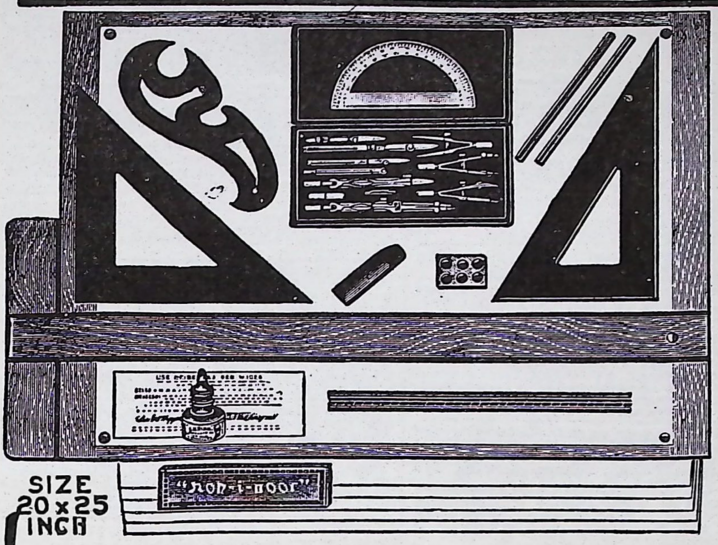
OLD coins, large spring selling catalogue of coins for sale, free. Catalogue quoting prices paid for coins, ten cents. William Hesslein, 101-A Tremont Street, Boston, Massachusetts.

STAMP collections, coins, bills, antique firearms, swords. Catalog free. Antique Shop, 33-A South 18th, Philadelphia, Pennsylvania.

FREE to our readers! How can I improve myself? How can I make myself more proficient, and thus earn more money? You don't have to go to college. Edison never went to college. But he has, we believe, the finest library of technical books in the world. If you want helpful, practical books on electricity, mechanics, mechanical engineering, wireless, automobiles, airplanes, sheet metal work, woodworking, repairing, or any other subject, write for Popular Science Monthly's new book catalog. The books described in it have been carefully selected by experts as best adapted to the needs of Popular Science Monthly readers. Our book catalog is free to our readers. A postal request will bring it. Book Department, Popular Science Monthly, 225 West 39th Street, New York City.

Quick-Action Advertisements continued on page 14

Drawing Outfit and Drawing Table FREE



SIZE 20 x 25 INCH

Complete Set of Drawing Instruments and Drawing Table

Yes, I will give you this complete drawing outfit absolutely free. The instruments are in a handsome high class, plush lined folding case. They are regular draftsman's working instruments. Besides I will give you absolutely free, a 20 x 25 inch drawing board, a 24 inch T square, a 12 inch rule, a supply of drawing paper, two triangles, a French curve, pencils, erasers, thumb tacks, etc.

Delivered at Once

The drawing table is the "Chief's Own" adjustable folding Drawing Table, same as used and needed by first class draftsmen. The complete outfit and table are delivered to you at once. You have them to work with from the very first day.

Be a Draftsman

Draw $250.00 to $300.00 Per Month

There is an urgent demand for skilled draftsmen. Companies are issuing calls every day for men to fill positions paying from $250.00 to $300.00 per month. Work is light, pleasant and profitable.

Chief Draftsman Will Instruct You Personally

I am Chief Draftsman of a large and well known firm. I have been doing the highest paying expert drafting work for a quarter of a century and I know just the kind of training that is demanded from men who get the big salaries. I train you by giving you actual, practical work, the kind that you must be able to do to hold permanent, big paying positions. I give you my individual instruction. If your work is right, I will advance you rapidly. If it is wrong, I will show you where and make you do it right, and do all I can to make you an expert draftsman and designer in a short time, *Write today without fail.*

Pay as You Wish

What I want is the *right kind* of men. Don't bother about expense. I will give you the working outfit free if you get in at once. I charge a very small fee for training you to be an experienced draftsman. You can pay the small cost as suits you best.

Send Coupon for My Big New Book

Put your name and address on the coupon or a letter or a post card and send it to me today. I will send you, absolutely free and postpaid, my new book "Successful Draftsmanship," and the great special offer that I am now making on which you get the complete Draftsman's Working Outfit and Drawing Table **absolutely free.** You assume no obligations of any kind in sending in the coupon. Get in line for a big paying position. Getting the book and full particulars of the special offer is the first step. Don't delay—send the coupon today.

Chief Draftsman Dobe Engineers' Equipment Co., Inc. Division 1363 -CHICAGO, ILL.

Chief Draftsman Dobe, Engineers' Equipment Co., Inc.
Div. 1363 Chicago, Illinois

Without any obligations on me whatsoever, please mail your book, "Successful Draftsmanship," and full particulars of your liberal "Personal Instruction" offer to a few students. It is understood that I am obligated in no way whatever.

Name .....

Address .....

.....

PATENT ATTORNEYS

PATENTS. If you have an invention which you wish to patent you can write fully and freely to Munn & Co., for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation. All communications are strictly confidential. Our vast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our handbook on Patents is sent free on request. This explains our methods, terms, etc., in regard to Patents, Trade Marks, Foreign Patents, etc. "Scientific American" contains Patent Office Notes. Decisions of interest to inventors—and particulars of recently patented inventions. Munn & Co., Solicitors of Patents, 624 Woolworth Building, New York, and 625 F Street, Washington, D. C.; Tower Building, Chicago, Illinois; Hobart Building, 582 Market Street, San Francisco, California.

WE have recently associated with us three former members of the examining corps of the United States Patent Office. Mason, Fenwick & Lawrence, Lawyers, 600 F Street, Washington, D. C.—220 Broadway, New York City—111 West Monroe Street, Chicago, Illinois. Established over half a century.

PATENTS—Herbert Jenner, Patent Attorney and Mechanical Expert, 622 F Street, Washington, D. C. I report if a patent can be had and its exact cost. Send for circular.

PATENTS. Foremost word sent. Write now. Metzger, Washington, D. C.

"INVENTORS Adviser" sent free on request. William C. Linton, 918 F Street, N. W., Washington, D. C. 362 University Street, Montreal, Canada.

PATENTS. Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 624 F Street, Washington, D. C.

PATENTS—Fees in installments. Frank T. Fuller, formerly Lieutenant, Engineers, Washington, D. C.

INVENTIONS patented· trade-marks registered: labels, prints, publications copywrited; prompt service; reasonable fees; plain advice; request detailed information before placing your business. Jaynes & Jaynes, 801 Kellogg, Washington, D. C.

PATENT applications filed on partial payment plan. Trade-marks, copyrights, etc. Milo B. Stevens & Company, 640 F Street, Washington. Established 1864.

PATENTS Promptly Procured—Personal, careful and efficient service. Highest references. Moderate fees. Send sketch or model for actual search and advice. George P. Kimmel, Master of Patent Law, 38-D Loan & Trust Building, Washington, D. C.

LACEY Patent-Sense. "The book the inventor keeps." Free. See page 130.

PATENTS. Trade Marks, Copyrights. Prompt, personal, reliable service. Over 30 years' active practice. Write for terms. Book free. Address E. G. Siggers, Box 1, N. U. Building, Washington, D. C.

PATENTS—Trademarks. I offer you prompt, personal, efficient service. Handbook giving valuable detailed information sent free on request. Write to-day. Clarence A. O'Brien, Patent Lawyer, Woodward Building, Washington, D. C.

"PROTECT your rights. Write for "Record of Invention," which contains forms to establish evidence of conception of your invention. Prompt personal service. Preliminary advice without charge. J. Reaney Kelly, 732 Woodward Building, Washington, D. C.

FREE Book on Patents. Write to-day for free copy of "How to Obtain a Patent." Contains valuable information and advice to inventors. Tells how to secure patents. Send model or sketch of your invention for opinion of its patentable nature—free. (20 years' experience.) Talbert & Talbert, 4624, Talbert Building, Washington, D. C.

PATENTS—Write for free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch of invention. for free opinion of its patentable nature. Highest References. Prompt attention. Reasonable terms. Victor J. Evans & Company, 155 Ninth, Washington, D. C.

INVENTORS, send sketch or model of your inventions for opinion concerning patentable nature and exact cost of applying for patent. Book, "How to Obtain a Patent," sent free. Gives information on patent procedure and tells what every inventor should know. Established twenty-five years. Chandlee & Chandlee, 412 Seventh Street, N. W., Washington, D. C.

M. E. MILLER, Ouray Building, Washington, D. C., patent attorney, mechanical and electrical expert. Best quality of work and results. Moderate charges. Advice free.

DON'T lose your rights to patent protection. Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. Form and information concerning patents free. Lancaster & Allwine, 232 Ouray Building, Washington, D. C. Originators of the form "Evidence of Conception."

PATENTS procured—trade marks registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Building, Washington, D. C., or 2276-Z Woolworth Building, New York.

PATENTS, prompt, personal, efficient service by an Attorney-at-law skilled in all branches of Patent practice. Over 12 years' actual experience. Full information on request. B. P. Fishburne, 323 McGill Building, Washington, D. C.

PATENT Attorney. Consulting Engineer. High-class patent service in all its branches. Write for particulars. M. H. Loughridge, 1457 Broadway, New York.

MECHANICAL Appliances, Mechanical Movements and Novelties of Construction.—This volume contains illustrations and descriptions of many combinations of motions and of mechanical devices and appliances found in different lines of machinery, each device being shown by a line drawing with a description showing its working parts and the method of operation. Such items as conveyors and elevators, Prony brakes, thermometers, various types of boilers, solar engines, oil-fuel burners, condensers, evaporators, Corliss and other valve gears, governors, gas engines, water motors of various descriptions, air ships, motors and dynamos, automobiles and motor bicycles, railway lock signals, car couplers, link and gear motions, ball bearings, breech block mechanism for heavy guns, and a large accumulation of others of equal importance are fully described and illustrated. 1,000 specially made engravings. 396 octavo pages. Price, postpaid, $4.00. Book Dept., Popular Science Monthly, 225 West 39th Street, New York.

YOUR spare time properly used is worth at least $10.00 a week. Write for particulars. Popular Science Monthly, 225 West 39th Street, New York.

AGENTS AND SALESMEN WANTED

TAILORING Agents Wanted—Big complete sample outfit and case, nearly 200 large cloth samples, 3-price lists and everything needed for canvassing, or use in store, free to live agents. $25.00 to $50.00 a week; may make more. Write us to-day for free elegant outfit to begin, cloth samples, wholesale prices, special offer on a suit for yourself and full information. See our wonderful values, beautiful fabrics and styles. Established 28 years. Every garment made to measure—everything guaranteed and express prepaid. Just send a postal. American Woolen Mills Company, Dept. 1407, Chicago.

AGENTS—Make a dollar an hour. Sell Mendets, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Company, Dept. 467, Amsterdam, New York.

NEW Auto Wonder; science makes startling discovery; no more rain or snow-blurred windshields; wonderful chemical cloth works like magic; one rub keeps glass clear 24 hours; 30,000 sold first month; territory free—worth fortune. Security Mfg. Company, Dept. 217, Toledo, Ohio.

SOMETHING new. A combination shoe horn and buttoner—not a button-hook—for universal use. Sells on sight at 15c; 100% profit. Sample 15c. Particulars free. Liberty Novelties, 123 Liberty Street, New York.

$40 to $100 a week. Free samples. Gold sign letters anyone can put on windows. Big demand. Liberal offer to general agents. Metallic Letter Company, 431A North Clark, Chicago.

AGENTS—Something different. Our Eradium (Luminous) Crucifix, actually shines in the dark. Startling! Mysterious! Wonderful! Enthusiasm follows every demonstration. 150% profit on every sale. Sole manufacturers. The Pioneer Corporation, 1263 West 63rd Street, Chicago, Illinois.

WONDERFUL New Chemical. $1.00 Package equal 50 gallons gasoline. Eliminates carbon. 50% more mileage, power, speed. Guaranteed. Whirlwind sellers. Auto owners buy on sight. 100% profit. Repeater. Demonstrating package, terms, territory, 10c postage. Sample free. H. Marui Company, 36 Baird, Cambridge, Ohio. Myers & Company,

IDEAL Sideline. Business men buy on sight. $1.00 seller, 400% profit. N. Home, 1957 Warren, Chicago.

WONDERFUL chance! Men's shirts and furnishings at wholesale rates, or make $10 daily starting real business. Goodell Company, 83 Duratex Building, New York.

MEN and Women—Become independent—own your business, experience necessary selling our $6,000 Accidental Death, $30.00 Accident, $25.00 Sick Weekly Benefit, $10.50 yearly, half amounts $5.50. Guaranteed steady income from renewals. $250,000 deposited Insurance Department. Registration Dept. S. Newark, N. J.

$10 or more a week for your spare time collecting new and renewal subscriptions. We want representatives in every town in the United States. A. J. MacElroy, Subscription Manager, Popular Science Monthly, 225 West 39th Street, New York.

VULCANIZING Auto Tires growing and profitable business, especially now. Easy to learn. Instruction book $1. Plants $50 up. Catalog free. Equipment Company, 149 Canal, Cincinnati, Ohio.

MAKE and Sell Your Own Goods. Machinery unnecessary. Expert Chemists advice. Special attention to beginners. Write for Formula Catalog, Elmer Mystic Company, Washington, D. C.

WANTED: Man with auto in every section to sell our Big Six-In-One tool, comprising vise, pipe vise, anvil, drill press, cutting hardie and corundum grinder. Every farmer, janitor, private or public garage, small shop, etc., a prospective buyer. Outfit weighs 90 pounds, sells for $20 with a fat profit to you. No trick to sell. Always pleases. Write Chicago Flexible Shaft Company, Dept. H. W. 5600 West 12th Street, Chicago.

AGENTS: Big money selling great household invention. Sample 25c. Particulars free. Webster & Company, 2935 North Clark Street, Chicago.

SALESMEN wanted to sell Electric Cigar Lighters and Moisteners. Salary or Commission. You carry stock or we ship direct. Write for Special Offer. Drake Manufacturing Company, 220 Grand, Milwaukee, Wisconsin.

SEND for free catalogue "Golden Opportunities" Typewritten formulas, trade secrets in every line, chemical analyses. 23 years manufacturing experience. No humbuggery. Satisfaction guaranteed. Industrial Sales Service, 73 Washington, Memphis, Tennessee.

$1,000 per Man per County; Strange invention startles world—agents amazed. Ten inexperienced men divide $40,000. Korstad, a farmer, did $2,200 in 14 days. Sleicher, a minister, $195 first 12 hours. $1,200 cold cash, made, paid, banked by Stoneman, in 30 days; $15,000 to date. A hot or cold running water bath, equipped for any home at only $6.50. Self-heating. No plumbing or water-works required. Investigate. Exclusive sale. Credit given. Send no money. Write letter or postal to-day. Allen Mfg. Co., 541 Allen Building, Toledo, Ohio.

MAN in each town to refinish chandeliers, brass beds, automobiles, by new method. $10 daily without capital or experience. Write Gunmetal Company, Avenue "F," Decatur, Ill.

PATENTS. Write for Free Illustrated Guide Book. Send sketch or model for free opinion of its patentable nature. Highest references. Prompt attention. Reasonable Terms. Victor J. Evans & Co., 174 Ninth, Washington, D. C.

SALESMEN, high grade, for state and county agencies; practical device rings electric bells forever without batteries; made by leading manufacturer. Sound, permanent business; men are already making good money; territory being rapidly assigned; references and previous experience essential. Betts & Betts Corporation, Betts Building, 42nd Street, New York.

AGENTS: Big profits. Best and cheapest window letters made. Easily applied. Dime brings five samples. Particulars free. Stairbrite Company, 1115 Second Avenue, New York.

SALESMEN—City or travelling. Experience unnecessary. Send for list of openings and full particulars. Prepare in spare time to earn the big salaries—$2,500 to $10,000 a year. Employment services rendered Members. National Salesmen's Training Association, Dept. 126C, Chicago, Ill.

WONDERFUL Adding Machine—Seven column capacity—retails for one dollar. Sells itself everywhere. Most offices purchase several. Sensational agency proposition. L. J. Leishman Co., Dept. F, Ogden, Utah.

AGENTS: Sell rich looking 36x38 imported rugs, $1.00 each. Carter, Tenn., sold 115 in 4 days; profit, $57. You can do same. Write for sample offer and selling plan; exclusive territory. Sample rug by parcel post prepaid, $1.19. E. Condon, Importer, 12 Pearl Street, Boston, Massachusetts.

AGENTS make 500% profit handling auto monograms, new patriotic pictures, window letters, transfer flags and novelty signs. Catalog free. Hinton Company, Star City, Indiana.

WERE you ever offered a grocery store? You can handle Sugar, Flour, Canned Goods, Dried Fruit, Coffee and entire line of Groceries, as well as Paints, Roofing, Aluminum Ware and Automobile Oils, with no rent to pay; no money invested; take large orders from samples. Goods are guaranteed and proven quality. Selling experience not necessary. Steady, profitable work for "workers." Address Hitchcock-Hill Company, Dept. 220, Chicago, Illinois. Reference: any Bank or Express Company.

AGENTS, $10 profit on every sale. Russell sold 327 in 5 months; Elliott 187 in 2 months. Oliver Oil Gas Burner makes 2 gallons kerosene equal 97 pounds coal; fits any coal or wood stove. More heat, turns on and off like gas. Write Oliver Oil-Gas Burner Co., 1342 North 7th. St. Louis, Missouri.

KEROSENE Burners for Furnaces, Cook and Heating Stoves. Economy Mfg. Company, 616 West Monroe, Chicago.

SELL the line that hasn't been worked to death. 25% to 31% more than usual for selling staples. $50 a week easy. $100 a week quite common for those selling our Sanitary Brushes, Dustless Mops and Dusters. Good territory available. Promotion for producers. Modern factory and convenient distributing houses assure good service. North Ridge Brush Company, 115 Clark Avenue, Freeport, Illinois.

$5.00 to $25.00 daily monogramming automobiles, etc., with Globe Transfer Initials. Particulars free; samples 10c. Globe Decalcomania Company (Factory), Newark, New Jersey. West of Rockies, 1785 Green Street, San Francisco.

SPLENDID opportunity for live sales managers to control City, County and State agencies for "Rexblu." Stevens Wiley Mfg. Company, Inc., Fairhill and Diamond Streets, Philadelphia.

SIGNS for stores and offices. Entirely new. $50 week easily made. Chicago Sign System, T-326 River Street, Chicago.

AGENTS—Newest invention: "Inkspoon" makes every pen a fountain pen. Fast office seller; big profits; demand increasing everywhere. Exclusive territory offered. Sample free. H. Marui Company, Tribune Building, New York.

AGENTS—Steady Income. Large manufacturer of Handkerchiefs and Dress Goods, etc., wishes representative in each locality. Factory to consumer. Big profits, honest goods. Whole or spare time. Credit give. Send for particulars. Freeport Mfg. Company, 24 Main Street, Brooklyn, N. Y.

BIG earnings easy. Five startling inventions. Quick selling auto accessories. Sell to owners, dealers, agents. Exclusive territory. Write quick. Jubilee Mfg. Company, Station C-54, Omaha, Nebraska.

AGENTS and Crew Managers: New fast selling food specialty. Livest article. Packed your label. Write or wire. Federal Pure Food Company, 2305-H Archer Avenue, Chicago.

SENSATIONAL Ford invention. Ford owner reports 100% mileage increase! Prevents carbon. Chance of lifetime for agents! Write Gasoline Economy Company, 1608 Colonial Trust Building, Philadelphia.

GET our plan for monogramming automobiles, trucks, hand luggage and all similar articles by transfer method; experience unnecessary; exceptional profits. Motorists, Accessories Company, Mansfield, Ohio.

HERE'S a line you can sell! Big profits too! Fruit drinks, spices, extracts, toilet articles, vegetable soaps, remedies, household preparations. Over 125 products, all guaranteed. Branches at New York City, Memphis, San Francisco, Winnipeg and Hamilton give prompt shipping service, low freight rates. Ours is the oldest, largest and most successful agency house in the world. Particulars free. Write to-day. Dept. 14, The J. R. Watkins Company, Winona, Minnesota.

YOUR opportunity—Get in business for yourself; mail order or local; manufacture your own products; employ other agents; everything given clearly in our big magazine of plans, schemes and ideas. Three months, 25c. Sample copy, 10c. Special Service, 419 Shannon Building, Pittsburgh, Pennsylvania.

INSYDE Tyres, inner armor for Automobile Tires, prevent punctures and double mileage of any tire. Liberal profits. Details free. American Accessories Co., Dept. 97, Cincinnati, Ohio.

SIGN Agents to represent us in your locality. Unlimited field, samples and particulars free. Interstate Sign Company, 2624 North Halsted Street, Chicago.

"STOVOIL" is not merely stove polish, but a rust killer and preventive. Women are crazy about it. Profits big and fast. Write at once. Much repeat business. Superior Laboratories, Dept. 29C, Grand Rapids, Michigan.

AGENT Johnson made $10.00 first evening. Particulars, "Taymor," W-335 Broadway, New York.

WE pay $100 monthly salary and furnish rig and expenses to introduce guaranteed poultry and stock powders. Bigler Company, X371, Springfield, Illinois.

AGENTS: New reversible raincoat. Elegant style. Finished on both sides. Two coats for the price of one. Every business man, clerk, mechanic, truck driver, wants one. Ideal for men doing outdoor work. Guaranteed waterproof. Great seller. Binford sold 26 coats in 5 days. Write quick for agency and sample to workers. Thomas Raincoat Company, 1961 North Street, Dayton, Ohio.

GET into the automobile game. Sell Champion guaranteed red inner tubes. Sales easy. Profits large. Big repeat business. Champion Rubber Company, Trenton, New Jersey.

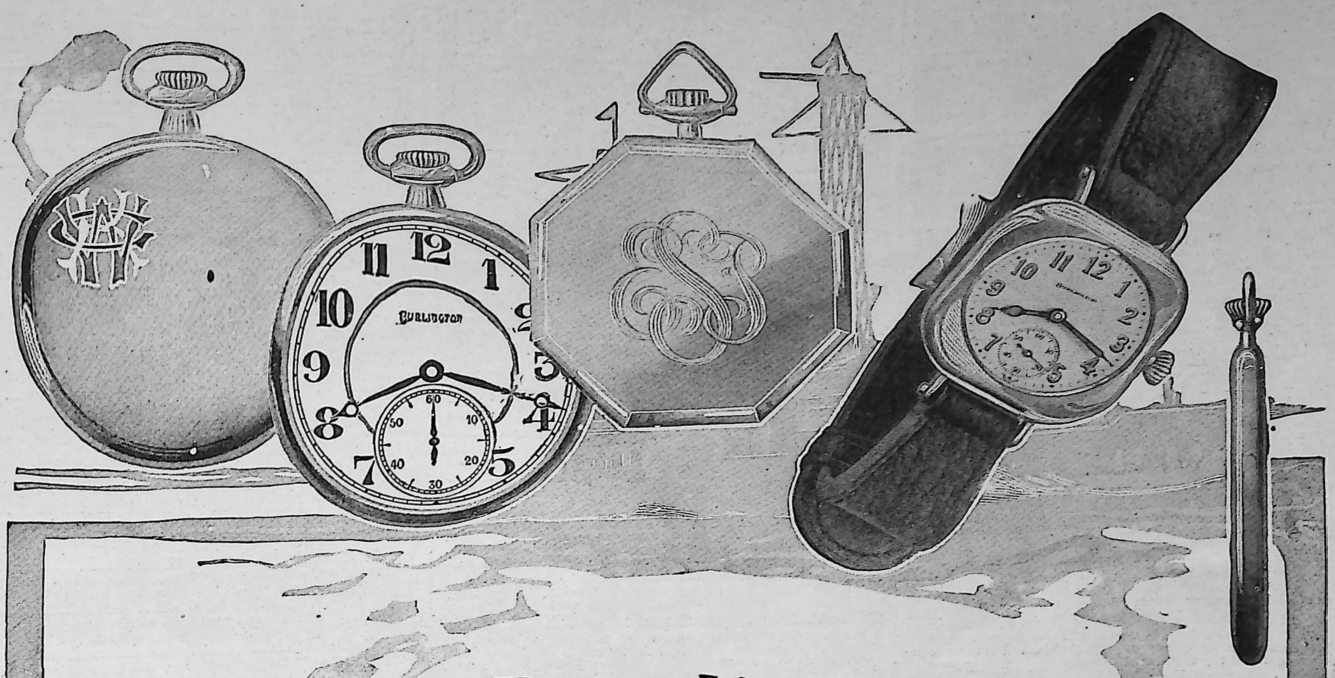
AGENTS make $50 weekly selling Accident and Sickness Policies for $10 yearly. Pays $5,000 death, increasing to $7,500. Also $25 weekly benefit for accident or sickness. Quick claim settlements. Permanent income from renewals. $100,000 deposited with State. Address Insurance Company, Dept. A-1, Newark, New Jersey.

500 AGENTS wanted at once for Mitchell's Magic Marvel Washing Compound. 300% profit, enormous repeater. Washes clothes spotlessly clean in ten to fifteen minutes. One thousand other uses in every home. Astounds and delights every woman. Nothing else like it. Nature's mightiest cleanser. Contains no lye, lime, acid or wax. Free samples furnished to boost sales. We positively guarantee the sale of every package. Exclusive territory. Own your own business. You cannot fail to make big money. Barber, Ohio, made $600 last month. Send for free sample and proof. Hurry, hustle, grab this chance. L. Mitchell & Company, Desk 301, 1312-1314 East 61st, Chicago.

SELL necessities. Everybody needs and buys the "Business Guide." Bryant cleared $800 in July. Send for sample. It's free. Nichols Company, Box 1B, Napierville, Illinois.

AGENTS—300% profit on our Photo Enlargements, Medallions, Luminous Crucifix, War Books, Religious and Patriotic Pictures. Send for prices and circulars today. Excel Supply House, 6243 So. Justine Street, Chicago, Illinois.

Quick-Action Advertisements continued on page 16



8,320 Burlingtons in the U. S. Navy—

8,320 Burlingtons have been sold to the men aboard the U. S. battleships. Practically every vessel in the U. S. Navy has many Burlington watches aboard. Some have over 100 Burlingtons. The victory of the Burlington among the men in the U. S. Navy is testimony to Burlington superiority.

A watch has to be made of sturdy stuff in order to "make good" on a man-of-war. The constant vibration, the extreme heat in the boiler rooms, the cold salt air and the change of climate from the Arctic to the Tropical are the most severe tests on a watch. If a watch will stand up and give active service aboard a man-of-war, it will stand up anywhere.

21-Jewel Burlington $3.50 A Month

And yet you may get a 21-jewel Burlington for only $3.50 a month. Truly it is the master watch. 21 ruby and sapphire jewels, adjusted to the second, temperature, isochronism and positions. Fitted at the factory in a gold strata case, warranted for 25 years. All the newest cases are yours to choose from. You pay only rock-bottom price—yes, "bed rock-bottom price"—the lowest price at which the Burlington is sold.

See It First! You don't pay a cent to anybody until you see the watch. We ship the watch to you **on approval.** You are the sole judge. No obligation to buy merely because you get the watch on approval.

Write for Booklet!

Put your name and address in the coupon or on a letter or post card now and get your Burlington Watch book free and prepaid. You will know a lot more about watch buying when you read it. Too, you will see handsome illustrations in full color of all the newest cases from which you have to choose. The booklet is free. Merely send your name and address on the coupon.

Burlington Watch Company,
19th Street and Marshall Blvd., Dept. 1363 Chicago, Illinois
Canadian Office: 338 Portage Ave., Winnipeg, Man.

Burlington Watch Co., Dept. 1363,
19th Street & Marshall Blvd., Chicago, Ill.

Please send me (without obligations and prepaid) your free book on watches with full explanation of your cash or $3.50 a month offer on the Burlington Watch.

Name.....

Address.....

.....

REPRESENTATIVE Wanted: To handle our complete line of fire protection and safety devices and accessories, such as AJAX Chemical Fire Engine on Wheels, pails and buckets, lanterns, fire escapes, and signs. Every factory, mill, store, mine, etc., is in the market for our extensive line. Representative wanted capable of earning $5,000 upwards in annual commissions. Ajax Fire Engine Works, Bush Terminal Building, Brooklyn, New York.

SALESMEN—New proposition, never shown before; every business man interested. Not a known competitor. Easy seller. Salesmen now earning $75 to $200 weekly with our original selling plan. We can convince you. Write for your territory. Surprise Mfg. Company, Peru, Indiana.

AGENTS: $100 weekly. Automobile owners everywhere wild with enthusiasm. Marvelous invention doubles power, mileage, efficiency. Saves ten times its cost. Sensational sales everywhere. Territory going like wildfire. $26 Sample Outfit and Ford Car free. Write quick, L. Ballwey, Dept. 181, Louisville, Kentucky.

AUTOMATIC Cuff Links. Cuffs over elbows instantly without unbuttoning; lowered, they close automatically. Sell like wildfire; great convenience and shirt savers; enormous demand everywhere. Liberal exclusive proposition for experienced agents. Expandolinks Jewelers, Sheboygan, Wisconsin.

"ONE RAINDROP" Window Operator; window shuts automatically. Sample postpaid, $1.00. Phelps, 2107 North Percy, Philadelphia.

AGENTS—Make $50 weekly taking orders for fast selling Goodyear raincoats. Hundreds of orders waiting. $2 an hour for spare time. We deliver and collect. Sample coat free. Write to-day for agency. Goodyear Mfg. Company, 303 Goodyear Building, Kansas City, Missouri.

REPAIR leaks permanently with Kenitram Mastic Cement; paste form easily applied with trowel; roofs, foundations below grade; flashings, around chimneys, greenhouses; seals joints, adheres any surface; applicable during rainstorm, quickly sealing leaks; waterproof, acid-proof. 50c. postpaid. Martinek, 405 Lexington Avenue, New York.

ONE SALE a day means $200 per month! Five a day—$1,000 per month! Marvelous new Automatic Adding Machine, retails $12.50. Work equals $300 machine. Five-year guarantee. Worth its price for inventory alone Write quick for protected territory and trial offer. Calculator Corporation, Dept. O, Grand Rapids, Michigan.

BIG profits putting gold initials on automobiles. Every body buys. Easily applied. Samples free. American Monogram Company, Dept. 28, East Orange, New Jersey.

AGENTS WANTED—Perfect furnace carburetor; sizes for any furnace; increases heat half; reduces soot, ash, labor and fuel; big profits. West Furnace Carburetor Company, Denver, Colorado.

FREE samples: Best line of cold creams, face powder, perfumes, remedies, soaps, extracts. Big profit. Catalogue free. Western Laboratories, 1957 West Van Buren, Chicago.

WIDE-AWAKE man to take charge of our local trade. $4.00 to $5.00 a day steady. No experience required; pay starts at once. Write today. American Products Company, 1464 American Building, Cincinnati, Ohio.

AGENTS—Men and women wanted. New Monitor Self-heating Iron; $30 to $50 a week actually being made now by men and women. The original—the best—the lowest priced. Nickel plated, looks good, makes good, sells fast. Guaranteed. No experience needed. Exclusive territory. Work all or spare time. Mrs. Nickson, Vt., sold 8 first half day. Evans, N. C., sold 2 dozen on Saturday. Liberal terms. Prompt service. Send for free outfit offer. Write today. The Monitor Sad Iron Company, 235 Fay Street, Big Prairie, Ohio.

SELL "Victorclean" Washing Wonder. It is wonderful repeater. Free samples to boost sales. Skytt, 725 East 5th, Duluth, Minnesota.

SALESMAN—Side or main line, to sell low priced 5,000 mile guaranteed tires. 30x3½ non-skid sells for $11.95; other sizes in proportion. Good money-making proposition for live wires. Write, Consolidated Tire Company, 1777 Broadway, New York, New York.

AGENTS wanted to sell our 25 light acetylene gas generator; fully guaranteed; cheap; safe and reliable. Write Daniel Zimmerman, Magley, Indiana.

SPECIAL for this month. Agents wanted everywhere! One dozen each article free with each dozen purchased, to introduce goods. Tornado Polish—Tornado Soap—La Miraflora Shampoo—La Miraflora Hand Lotion—Diamond Bar for silver and jewelry—La Miraflora Face Cream, each 25c; 30 per cent discount. $1 brings complete outfit. Marvel Specialties Company, 80 Walker Street, New York, New York.

CALIFORNIA Rosebeads selling like hot cakes. Agents coining money. New Stuff. Tremendous demand. Big profits. Mission Bead Company, Factory C, Los Angeles, California.

SALESMEN wanted. Full time. Side line. Each sale $8.00 commission. Continuous monthly renewal, $2.00. Two to five sales daily easy. Drug, Candy, Saloon, Grocery, Cigar Stores, Hotels. Collect and keep $5.00 each sale. Sanichu, Dept. F, 3624 Cottage Grove, Chicago, Illinois.

WOULD good durable Paints, Oil and Varnish, 40c gallon, interest YOU? Then write Dept. A, Emmelmann Bros. Mfg. Company, Indianapolis, Indiana.

EASY, pleasant work for mechanics, shop men, clerks, during spare hours, will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Company, 27 Bar Street, Canton, Ohio.

SALARY and commission. A real proposition. Permanent position. Every family a buyer. Earnings that keep you with us for life. An exceptional opportunity. You can't wait. Write now! New England Sales Syndicate, 305-306 First National Bank Building, New Haven, Connecticut.

$10.00 WORTH of finest Toilet Soaps, Perfumes, Toilet Waters, Spices, etc., absolutely Free to agents on our refund plan. Lacassian Company, Dept. 425, St. Louis, Missouri.

WE want live representatives in your locality selling Bull Dog Inner Tires. Inner casing for automobile tires. Guaranteed to prevent punctures and blow-outs, tire fabric not canvas. Double tire mileage. Easy to sell. Big demand. Protected territory. Agents making $150.00 weekly. Eastern Auto Specialty Company, Dept. B, Utica, New York.

MAN or woman, start anywhere; materials that cost 35c, retail for $5.00. Details free. Lee, Dept. 2, 3401½ University Avenue, Los Angeles, California.

MIRACLE Motor-gas amazes motorists. 3c worth equals gallon gasoline. Eliminates carbon. 300 per cent profit. Isom, Idaho, wires: "Ship 500 packages. Made $70 yesterday." Investigate. Chas. Q. Butler Company, Toledo, Ohio.

DELIGHTFULLY scented sachet envelopes. Quick, profitable seller, through sub-agents, boys, girls, premium; use 3 packets; particulars sent for dime. Ufert, 64 Bedford Street, New York.

WANTED—Ex-service men as subscription agents, "The Stars and Stripes." All or spare time, good commissions. Permanent proposition to producers. Write now for particulars and authority. 700-A Munsey Building, Washington, D. C.

HELP WANTED

IF you desire a position as wireless operator, worth $225 per month, we should like you to investigate our correspondence course by sending for catalog. We operate the one big radio school of the world and are turning out the winners. Write to-day. Service Radio School, Dept. M, 902 Pennsylvania Avenue, Washington, D. C.

MEN Wanted! I want a few more men to train as draftsmen. Experience not necessary. Draftsmen earn $150 to $300 per month. Big demand. Splendid opportunities. Learn quickly at home. Let me send you Free Lesson. No charge. Write to-day. Address, Charles W. Morey, Director, 2239 Chicago Technical Building, Chicago.

BE a finger print expert; $25 to $50 a week in this new and fascinating profession. Write—find out how you can learn at home to supply the big demand for finger print experts in banks, big factories, detective agencies, etc. Special limited offer—send for free illustrated book. Tells all about finger prints. University of Applied Science, Room 9203, 1810 Wilson Avenue, Chicago, Illinois.

GOVERNMENT positions are desirable. $1000-$2000 to start. Let our expert (Former Government Examiner) prepare you. Free booklet. Patterson Civil Service School, Box 5026, Rochester, New York.

WE want representatives in every factory. You can easily earn $10 or $15 a week by spending an hour a day of your spare time. Write A. J. MacElroy, Subscription Manager, Popular Science Monthly, 225 West 39th Street, New York.

BE a Detective. Good incomes. Excellent opportunities to travel. Particulars free. Write American School of Criminology, Detroit, Michigan.

WRITE for newspapers and magazines. Big pay, Experience unnecessary. Copyright book free. Press Reporting Syndicate, 4905, St. Louis.

GOVERNMENT positions highly desirable; thousands appointed annually through frequent examinations everywhere; prepare immediately for Post Office Clerk, City or Rural Letter Carrier, Railway Mail Clerk, Washington Departmental Clerk, Stenographer, Typist; unexcelled correspondence instruction, $5.00. Request particulars concerning position desired. Federal Civil Service School, 600 Kellogg, Washington, D. C.

DETECTIVES earn big money. Travel. Experience unnecessary. We train you. Particulars free. Write American Detective System, 1968 Broadway, New York.

RAILWAY Traffic Inspectors; $110.00 a month to start and expenses. Travel if desired. Unlimited advancement. No age limit. Three months home study. Situation arranged. Prepare for permanent position. Write for booklet CM13, Standard Business Training Institute, Buffalo, New York.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Missouri.

BE a Mirror Expert, $3-$10 a day; spare time home at first; no capital; we train, start you making and silvering mirrors, French method. Free prospectus. W. F. Derr, Pres., 579 Decatur Street, Brooklyn, N. Y.

FIREMEN, Brakemen, Baggagemen, $140-$200. Colored Porters, by railroads everywhere. Experience unnecessary. 830 Railway Bureau, East St. Louis, Illinois.

2000 Government Railway Mail Clerks wanted. Men, women, 18 up. $1,300 year to beginners. Write immediately for list positions open. Franklin Institute, Dept. O-50, Rochester, New York.

SILVERING Mirrors—I make the French Plate. Easy to learn; immense profits, booklet free. Sam Wear, Excelsior Springs, Missouri.

BE a detective. Would you like to be one? Write J. Ganor, former Government Detective, Danville, Illinois.

VULCANIZING auto tires growing and profitable business, especially now. Easy to learn. Instruction book $1. Plants $50 up. Catalogue free. Equipment Company, 21 Canal, Cincinnati, Ohio.

MEN—Age 17 to 45. Experience unnecessary. Travel, make secret investigations, reports. Salaries, expenses. American Foreign Detective Agency, 321, St. Louis.

WRITE Photoplays; $50 each. Experience unnecessary; details free to beginners. Producers' League, 194, St. Louis.

BECOME detectives—Big pay; easy work; write Wagner, Dept. 645, 186 East 79th Street, New York.

GET ON THE STAGE! Experience unnecessary. Send stamp for instructive booklet. "All About Vaudeville." LaDelle, Sta. 263, Jackson, Michigan.

STOP daily grind! Start silvering mirrors, auto headlights, tableware, etc. Plans free. Clarence Sprinkle, Dept. 95, Marion, Indiana.

12 MONEY-MAKING formulas and how to sell the goods. Send stamped envelope and one dime today. No stamps. Service Press, Box 535, Springfield, Massachusetts

WATERMAN'S Self-Instruction Civil Service Courses, new 336-page book. Quickly prepares for all examinations. By mail, $2.50. Money back if not satisfactory. Information free. Write today. Chicago Civil Service College, 801 Kesner Building, Chicago.

WANTED—Automobile experts. $50 week. Learn easily while earning. Write immediately. Franklin Institute, Dept. O-803, Rochester, New York.

MANUFACTURERS' AGENTS

RESPONSIBLE Sales Organization open to represent reliable manufacturers in New York on a commission basis. International Mercantile Sales Company, 110 West 40th Street, New York.

BOOKS AND PERIODICALS

100,000 USED books for sale, 35c up. Some cost $10.00 new; History, Scientific, Technical, Science, etc. Catalogues 10c. McCarthy, 1061 West Van Buren Street, Chicago, Illinois.

CONCORDIA contains essays, formulas, plans. Year's subscription 50c, trial 20 cents. Concordia Magazine, 11 Water, York, Pennsylvania.

USED Books. Bargains. Catalog. Higenes, K-2441 Post. San Francisco. (Books bought.)

INSTRUCTION Book (for shop use) on Vulcanizing Auto-Tires, $1. Tire Equipment Company, 19 Canal, Cincinnati, Ohio.

MONEY-SAVING Magazine offer. Catalog free. F. D. Johnson, 1620 East 68th Street, Chicago, Illinois.

SIMPLE Wireless Telephones and How to Make Them. A good book for the advanced radio amateur on the principles, construction and use of the wireless telephone. Price 25 cents postpaid. Book Dept., Popular Science Monthly, 225 West 39th Street, New York

BUSINESS OPPORTUNITIES

ENTER a new business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty, openings everywhere with all the trade you can attend to; easily learned by anyone at home in a few weeks, at small expense; no further capital required; no goods to buy, job hunting, soliciting or agency. Address Stephenson Laboratory, 15 Back Bay, Boston, Massachusetts.

BEGINNERS—Complete "Mail Order System." Address Box 1005, Atlantic City.

WE start you in business, furnishing everything. Men and women, $30.00 to $100.00 weekly operating our "New System Specialty Candy Factories" anywhere. Opportunity lifetime. Booklet free. H. Ragsdale Company, East Orange, New Jersey.

BUILD a genuine Choraleon Phonograph and save over half. Fine profits building and selling. We furnish motors, tone arms and necessary parts. Send for our catalog and Free blue print offer. Choraleon Phonograph Company, 323 Monger Building, Elkhart Indiana.

BIG profits raising Belgian Hares. We pay you $6.00 pair and express. Contract, literature 10c. Co-operative Supply Company, Dept. K, St. Francis, Wisconsin.

SUBSTANTIAL manufacturing corporation wants capable man to establish branch and manage salesmen; $300 to $1,500 necessary; you handle own money; will allow expenses to Baltimore if you will qualify. For particulars address Secretary, 416 North Howard Street, Baltimore, Maryland.

PATENT buyers' addresses 2c each. Patent News, 34, Washington, D. C.

ATTENTION! Your chance in life to own a dignified profitable business. We teach you the Real Estate business, Brokerage and Insurance Agency. Earn $5,000 year; office at home; no capital required. Stamp for booklet. Hayes Realty Company, Cincinnati, Ohio.

SIX Original, Selective Methods, outlining six separate, productive, different plans, that help you make money in your spare time. All mailed complete for $1.00. C. B. Collins, Middletown, Connecticut.

CONTROL new exclusive phonograph record exchange business for your town. $25 capital required. Sateo Science, Oneonta, New York.

I MADE $30 a week evenings with a small mail-order business. Free Booklet tells how. 2c postage. Al Scott, Cohoes, New York.

MANUFACTURERS—Patent-buyers: I have secured the patent rights to a mechanical toy embodying the features of the air-rifle in the form of an automatic pistol. Investigate. For particulars. Alfred Plauschinat, 1725 North 19th Street, Philadelphia, Pennsylvania.

GET an Automatic Fishpond and take in $1.00 a minute located in a park or traveling with a carnival. Automatic Fishpond Company, 2012-14 Adams Street, Toledo, Ohio.

MONEY Saved! All kinds of used correspondence courses sold. Also courses bought. Write Lee Mountain, Pisgah, Alabama.

BARGAINS—Used correspondence courses, all kinds, for sale. Dollars saved. (Courses bought.) Mac-Michael Educational Bureau, Dept. 48, Victor, New York.

RAISE Flemish Giants and Belgian Hares for us. $8.00 and express for all raised from our stock. Contract and booklet on housing, feeding, breeding, shipping, 10c. Hunters' Rabbitry, R-2, Valley Stream, New York.

DO you want to earn $3,000 to $5,000 a year? You can do it easily. See Anderson's Steam Vulcanizer ad, page 123.

WANTED—Ambitious workers everywhere to establish collection bureaus; be independent, make big income yearly, no capital required; we train and refer business to you; "Scientific Facts" Free. National Collection Bureau, Dept. 5, Columbus, Ohio.

FOR SALE—Dividend-paying oil royalties and leases. Address Perry D. Plain, 233 Jackson Avenue, Wichita, Kansas.

START Business. Practical chemists will supply you with formulas, trade secrets, chemical information, manufacturing processes, analysis. Klonin & Company, 5169 Jefferson Street, Philadelphia, Pennsylvania.

PATENTS Procured—Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Building, Washington, D. C. 2276-Z Woolworth Building, New York.

EXPERT Chemist will furnish Formula and Trade Secrets in all lines. Lists free. W. L. Cummings, Ph.D., Gordon Avenue, Syracuse, New York.

VULCANIZING Auto Tires growing and profitable business, especially now. Easy to learn. Instruction Book $1. Plants $50 up. Catalogue free. Equipment Company, 151 Canal Street, Cincinnati, Ohio.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 424 Westover Bldg., Kansas City, Mo.

DOLLARS yearly in your backyard. No ginseng, mushroom dope. New ideas. Investigate. Particulars free. C. Metz, 313 East 89th St., New York.

INSYDE tyres, inner armor for automobile tires, double mileage and prevent punctures and blowouts. Quickly applied. Cost little. Demand tremendous. Profits unlimited. Details free. American Automobile Accessories Co., Dept. 97B, Cincinnati, Ohio.

BUY and exploit practical inventions. Trade for property. Form companies. Sell county rights. Adam Fisher Mfg. Co., 183D, St. Louis, Missouri.

WOULD you like to study law in your spare moments? I have a splendid opportunity to offer you. Send me your name and address right now. C. F. Dunlap, 1027 Manhattan Building, Chicago.

"THE Vest Pocket Lawyer"—Here at last—in a single volume—a complete law course—clearly analyzed in understandable English. It is a daily guide — a manual of reference for the business man—the law student—the justice of the peace—the notary public—the farmer—the clergyman—the merchant—the banker the doctor. 350 pages, 112 legal forms. Price, postpaid, $1.00. Book Dept., Popular Science Monthly, 225 West 39th Street, New York.

"STORAGE Batteries Simplified. Action—Maintenance—Repair—Use." By Victor W. Page. A complete treatise on Storage Battery Operating Principles, Repairs and Applications. 320 pages. Fully illustrated. Price postpaid $2.00. Book Department, Popular Science Monthly, 225 West 39th Street, New York.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

SALESMEN

RETAIL CLERK · TEACHER · DOCTOR · ENGINEER · GROCER · BAKER · PLUMBER · LAWYER · POLICEMAN · DRUGGIST · CHAUFFEUR · BARBER · BOOKKEEPER · CARPENTER · SWITCHMAN · FIREMAN · ELECTRICIAN · MINER · MACHINIST · PAINTER · DENTIST · FARMER · ARTIST

Salesmen Top Them All In Making Money!

Choose wisely in deciding on your life's work! Don't be a drifter! Don't be a wage slave! Stop working for the other fellow. Stop breaking your neck and your back for barely enough to exist on. Get into a line of work where you get full credit for what you do. The salesman knows what he's worth because his sales sheets SHOW! The salesman is independent because his earnings depend on himself! The good salesman can sell ANYTHING. All fields are open to him. He can travel the country over or stay in his own city. He is respected, looked up to, admired. It's the cream of jobs.

The Best Paying Work You Can Do!

Think of the young lawyer after years of hard study, waiting for a case Think of the young doctor after years of effort, waiting for a patient. Think of the years of apprenticeship necessary in practically all other kinds of work and the pitiful wages afterward. Then think how easy it is to learn the secrets of Successful Salesmanship and the BIG MONEY you earn right from the start in this fascinating, brilliant "game."

Do You Want to Get Married? Do You Want to Own an Auto or a Home? Do You Want a Bigger Bank Account?

You **must** earn more money. Prices on everything have soared. Look what clothes cost. Look what a decent meal costs. Look what rent amounts to. You must overcome high prices by **earning** more. You can't do it unless you make yourself **worth** more. Cash in on your brain power. Turn your natural abilities into the **proper channel.** You can make more money as a STAR SALESMAN, **with less study,** than any other profession or trade you can name. You don't have to be an expert in ANYTHING except in MAKING PEOPLE SEE THINGS YOUR WAY. Let the other fellow produce new inventions. Let the other fellow do the manufacturing but YOU KEEP THEM BUSY with ORDERS! That's what they must have to keep the wheels going. That's why STAR SALESMEN earn $2500 to $10,000 and **more per year.**

You Can Become a Star Salesman—Let Me Prove It to You

Let me send you my wonderful new book "A Knight of the Grip," which tells about salesmanship in all its details. Let me tell you about the National Salesmen's Training Association and the special instructions which include every branch of selling and lessons on Language and Persuasion, Memory Training, Retail Selling, Advertising, Direct by Mail Selling, etc. I want to show you how we have trained thousands of others. I'll show you success letters we have received from hundreds of members. I'll show you what our Course includes and how it goes into every detail of Salesmanship from the ground up, covering Wholesale Houses, Specialty Houses, Retail Houses—how it covers every detail of the proposition, methods of distribution, territory covering, handling customers, personal efficiency, etc. I'll tell you about our Free Employment Bureau, which constantly has on file more requests for salesmen than we can possibly fill. Get all the facts by writing TODAY.

Write for My New Book—FREE

I want to send you my new book, "A Knight of the Grip," which tells all about our system of Salesmanship Training and Employment Service, in which we have specialized for more than twelve years. It tells you just what you want to know. If you are getting along slowly—if you are dissatisfied—if you want to earn big money instead of "peanut" wages, mail the coupon or a post card, or a letter for this free book now. Don't wait a minute. Do it right now.

Read What Others Have Done

Am Earning $92 a Week

After six months' success as a Traveling Salesman in a position secured through your Employment Bureau, I am earning $92 a week. P. W. Broedel, 726 Benedict Ave., Woodhaven, N. Y.

Earned $524 in Two Weeks

I had never earned more than $60 a month. Last week I cleared $306 and this week $218. You have done wonders for me. Geo. W. Kearns, 107 Park Place, Oklahoma City, Oklahoma.

Earned $6,500 Last Year

I formerly earned $800 as a clerk. Last year I earned $6,500 and was promoted to Sales Manager. Full credit due you. C. W. Birmingham, 129 Bank St., Dayton, Ohio.

Earns $375 in a Month

For ten years I worked for a railroad. Was drawing $75 a month when I left. You secured me my position. I have earned $375 in a month. Andrews St. Rockford, Illinois.

Address:

NATIONAL SALESMEN'S TRAINING ASSOCIATION

Dept. 15-C

Chicago, Illinois, U. S. A.

NATIONAL SALESMEN'S TRAINING ASSN., Dept. 15-C, Chicago, Ill., U. S. A.

With no obligation on my part please send me full information about the N. S. T. A. Training and Employment Service. Also a list showing lines of business with openings for salesmen.

Name .....

Street .....

City .....

State .....

New Words

Why not be up to date and know the new words and how to pronounce them correctly? Class yourself with those who know, with those who win success in all lines of activity.

MILITARY

salient
liaison
straddle
pup tent
drumfire
Archibald
escadrille

GREAT WAR

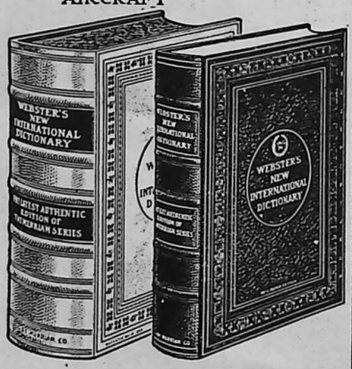
the Allies
Zeebrugge
fourth arm
camouflage
no man's land
Pact of London
Neuve-Chapelle

AUTOMOBILE

cyclecar
landaulet
crank case
convertible
brougham
demountable
motordrome

AIRCRAFT

Aviatik
décalage
air lane
squadron
Albatros
backswept
empennage



WEBSTER'S NEW INTERNATIONAL DICTIONARY

— "The Supreme Authority" — contains answers to questions about these new words and hundreds of thousands of other words. Where else is this information to be found? Get The Best.

400,000 Words and Phrases
2,700 Pages 6,000 Illustrations

Write for specimen pages, etc. Free pocket maps if you name Popular Science Monthly.

G. & C. MERRIAM CO.,
Springfield, Mass., U. S. A.

Gentlemen: Send specimens of Regular and India-Paper, Illus., Terms, etc., with *free* maps per Popular Science Monthly.

Name.....

Address.....

Big Pay

IN FASCINATING NEW

RAILROAD JOBS

Learn at home in spare time to fill a big-pay fascinating job as Signal Engineer. The demand is growing daily for men to install, supervise and maintain signal systems and other safety devices on railroads everywhere Steady employment; good salaries right from the start.

$2500 TO $5000 A YEAR!

Qualify for one of these jobs! Earn big money! Enjoy every minute of your work! Send today for free information about YOUR great opportunity as a Signal Engineer.

Write for Valuable FREE BOOK

Just write a post-card or a letter NOW and ask us to send you our handsome new book—64 pages, fully illustrated, telling all about this wonderful profession and the big pay jobs awaiting you. Find out how you can quickly qualify in your spare time. This great book is absolutely FREE! Write for it at once. Address

DEPARTMENT OF SIGNALING
Dept. 1203, 1810 Wilson Ave.
CHICAGO, ILL.

FREE course in Secret Service

MORE Finger Print Experts are needed. Men who are masters of this profession are scarce. The demand for Finger Print Experts is great. As a special inducement we will give you free of charge our new easy reading course in Secret Service Intelligence if you act at once.

Be a Finger Print Expert

Build up a business on the basis of a trained brain. You can do it as a master of the Finger Print profession. There is crying need for Finger Print Experts right now and the demand for these trained men is growing every day. A profession that offers wonderful opportunities for advancement. Governments, corporations, police departments, institutions and individuals have constant use for these specially trained men. The work is fascinating and

The Pay Is Big!

No special education is necessary. *You* can become a master of this profession by studying at home in your spare time. Expert Finger Print men travel all over the country solving mysteries that baffle all others. They are important men and highly regarded and envied by every one.

Mail the Coupon

Get full information about this great profession and our big offer of a free course in Secret Service Intelligence. The mastery of these two closely allied professions places a brilliant career within your grasp. Achievements that will immediately place the stamp of success upon you, are now possible. Send this coupon for full information NOW.

University of Applied Science

Desk 1203, 1772 Wilson Ave., Chicago

Gentlemen: Without any obligation whatever send me your new FREE book on Finger Prints and your offer of a free course in Secret Service Intelligence.

Name .....

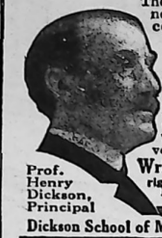
Address .....

Age.....*Occupation* .....

Stop Forgetting — Memory the Basis of All Knowledge

The Key To Success

The secret of business and social success is the ability to remember. I can make your mind an infallible classified index from which you can **instantly** select thoughts, facts, figures, names, faces. Enables you to **concentrate, develop self-control, overcome bashfulness, think on your feet, address an audience.** Easy. Simple. The result of 20 years' experience developing memories of thousands.



Prof. Henry Dickson, Principal

Write Today for free booklet "How to Remember" and **Copyrighted Memory Test,** also how to obtain my FREE book, "How To Speak In Public."

Dickson School of Memory, 1929 Hearst Bldg., Chicago, Ill.

Learn Electricity IN 3½ MONTHS

No need of taking from 1 to 4 years at America's greatest practical institution. Finest equipment. No books. No classes. All individual instruction. No special education necessary. Day and evening school. Open all year. Enter any time. Earn while you learn. Also courses in Drafting, Plumbing and Motion Picture Operating.

Send for free book now. Be sure to state which course interests you.

COYNE TRADE AND ENGINEERING SCHOOL
Dept. 33 39-51 E. Illinois St., Chicago, Ill.

Gov't Jobs

Short hours. Easy work." No strikes. No hard times Steady, lifetime positions, $75 to $150 a month to start. Quick promotion.

MEN WANTED!

If you are an American Citizen 18 or over write for FREE book that tells about these and many other wonderful advantages offered by U. S. Government. Railway Mail, Post Office, Custom House, Internal Revenue, Immigration, and Rural Carrier, Panama Canal and other divisions. Prepare under former Civil Service Secretary-Examiner. You can qualify. Write for FREE BOOK and Special 20 Day Offer NOW.

Patterson Civil Service School, 163 News Bldg., Rochester, N.Y.

I TEACH Penmanship BY MAIL

I won World's First Prize for best course in Penmanship. Under my guidance you can become an expert penman. Am placing many of my students as instructors in commercial colleges at high salaries. If you wish to become a better penman, write me. I will send you FREE one of my **Favorite Pens** and a copy of the Ransomerian Journal. Write today.

C. W. RANSOM, 488 Essex Bldg., Kansas City, Mo.

STAMMER

If you stammer attend no stammering school till you get my big new FREE book and special rate. Largest and most successful school in the world curing all forms of defective speech by advanced natural method. Write to-day.

North-Western School for Stammerers, Inc.
2335 Grand Avenue Milwaukee, Wis.

DO YOU LIKE TO DRAW?

Cartoonists are well paid

We will not give you any grand prize if you answer this ad. Nor will we claim to make you rich in a week. But if you are anxious to develop your talent with a successful cartoonist, so you can make money, send a copy of this picture, with 6 cents in stamps for portfolio of cartoons and sample lesson plate, and let us explain.

The W. L. EVANS SCHOOL OF CARTOONING
825 Leader Bldg. Cleveland, Ohio

Learn Watch Repairing

Be a watchmaker—you can learn this profitable trade by correspondence in a few weeks in your own home by the DeSelms Chart System. After you complete the course you will know a watch from A to Z. You will know just what the matter is and how to repair one. When you graduate you will be a practical watchmaker and repairer and competent to fill any position. Positions for our graduates.

Ask for our Free Book. It explains our system and terms.

THE DeSELMS WATCH SCHOOL
687 Perry St., ATTICA, IND.

STAMMERING

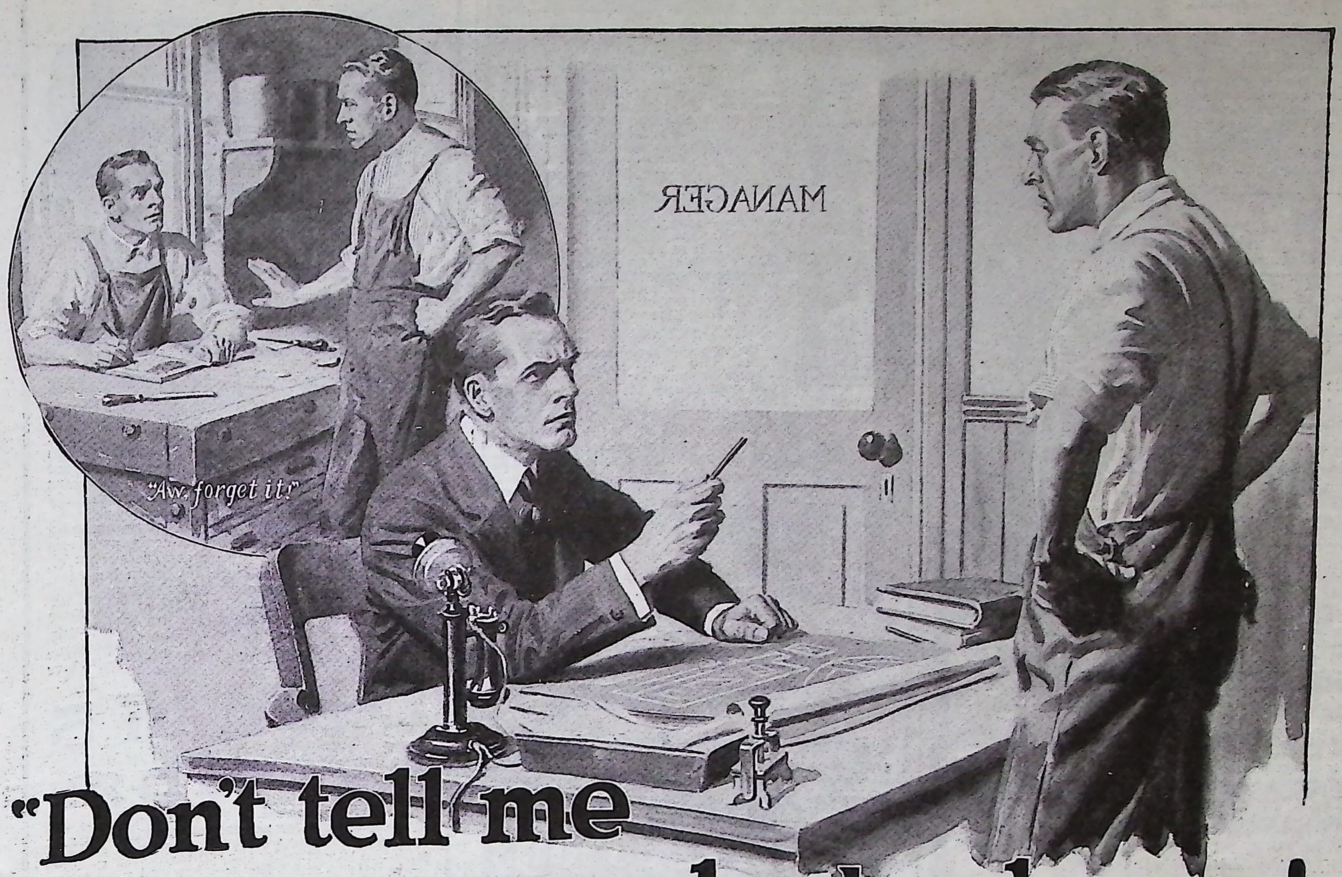
Complete and permanent cure effected at Bogue Institute. An institution with national patronage, for stammerers only. Founded 1901. Scientific treatment—combines training of brain with speech organs. Strongly endorsed by medical profession. 70 page book with full particulars, mailed free to all stammerers. Address

BENJAMIN N. BOGUE, President
664 Bogue Building, Indianapolis, Ind.

Be an Artist

Comics, cartoons, commercial, newspaper and magazine illustrating. Pastel crayon portraits and Fashions. Earn $25 to $200 a week. By our simple method your talent is quickly developed without interfering with present work. By Mail or Local Classes. The largest practical art School in the world. Write for full particulars and list of successful pupils, illustrated prospectus, etc. Endorsed by newspapers and magazines.

ASSOCIATED ART STUDIOS, 58D, Flatiron Building, New York, N. Y.



"Don't tell me you never had a chance!

"Four years ago you and I worked at the same bench. We were *both* discontented. Remember the noon we saw the International Correspondence Schools' advertisement? That woke me up. I realized that to get ahead I needed special training, and I decided to let the I. C. S. help me. When I marked the coupon I asked you to sign with me. You said, 'Aw, forget it!'

"I made the most of my opportunity and have been climbing ever since. You had the same chance I had, but you turned it down. No, Jim, you can't expect more money until you've trained yourself to handle bigger work."

There are lots of "Jims" in the world—in stores, factories, offices, everywhere. Are *you* one of them? Wake up! Every time you see an I. C. S. coupon your chance is staring you in the face. Don't turn it down.

Right now over one hundred thousand men are preparing themselves for bigger jobs and better pay through I. C. S. courses.

You can join them and get in line for promotion. Mark and mail this coupon, and find out how.

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7666, Scranton, Pa.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 7666, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electric Lighting and Railways
- ☐ Electric Wiring
- ☐ Telegraph Engineer
- ☐ Telephone Work
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Machine Shop Practice
- ☐ Toolmaker
- ☐ Gas Engine Operating
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREMAN OR ENGINEER
- ☐ STATIONARY ENGINEER
- ☐ Marine Engineer
- ☐ Ship Draftsman
- ☐ ARCHITECT
- ☐ Contractor and Builder
- ☐ Architectural Draftsman
- ☐ Concrete Builder
- ☐ Structural Engineer
- ☐ PLUMBING AND HEATING
- ☐ Sheet Metal Worker
- ☐ Textile Overseer or Supt.
- ☐ CHEMIST
- ☐ Mathematics
- ☐ SALESMANSHIP
- ☐ ADVERTISING
- ☐ Window Trimmer
- ☐ Show Card Writer
- ☐ Sign Painter
- ☐ Railroad Trainman
- ☐ ILLUSTRATING
- ☐ Cartooning
- ☐ BUSINESS MANAGEMENT
- ☐ Private Secretary
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Public Accountant
- ☐ TRAFFIC MANAGER
- ☐ Railway Accountant
- ☐ Commercial Law
- ☐ GOOD ENGLISH
- ☐ Teacher
- ☐ Common School Subjects
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ AUTOMOBILE OPERATING
- ☐ Auto Repairing
- ☐ Navigation
- ☐ AGRICULTURE
- ☐ Poultry Raising
- ☐ Spanish
- ☐ French
- ☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____

Canadians may send this coupon to 7-26-19
International Correspondence Schools, Montreal, Canada

Finish This Story For Yourself—

The girl got $6 a week and was lonely. "Piggy"—you can imagine his kind—was waiting downstairs. He knew where champagne and music could be had. But that night she didn't go. That was Lord Kitchener's doing. But another night?

O. Henry
(12 Volumes)

tells about it in this story, with that full knowledge of women, with that frank facing of sex, and that clean mind that has endeared him to the men and women of the land.

To Those Who Are Quick
JACK LONDON
5 Vols. Given Away

Never was there an offer like this. Not only do you get your 274 O. Henry stories in 12 volumes at less than others paid for one volume of the first edition, but you get Jack London's Works, 5 handsome volumes—without paying a cent. You get 17 volumes, packed with love and laughter—a big shelf full of handsome books.

SHIPPED ON APPROVAL

We will ship the two complete sets so that you can look them over in your home and then decide whether or not you wish to buy. If you are not delighted with O. Henry and the free Jack London notify us and we will take the sets back as cheerfully as we sent them. How could any proposition be more fair?

INSPECTION COUPON

THE RIVERSIDE PUBLISHING CO., (3-20)
140 So. Dearborn St., Chicago, Ill.

Please ship me on approval the Works of O. Henry, 12 volumes, Fabrikoid binding, gold tops. Also the 5 volume set of Jack London bound in silk cloth. If I keep the books I will pay you $1.00 as first payment within 10 days after *books* are received and $3.00 per month until your special price of $29.00 for the O. Henry set only is paid, and it is agreed I am to retain the Jack London set without charge. If not satisfactory I will notify you within 10 days and return both sets to you as soon as you give me shipping instructions as offered readers of *Popular Science*.

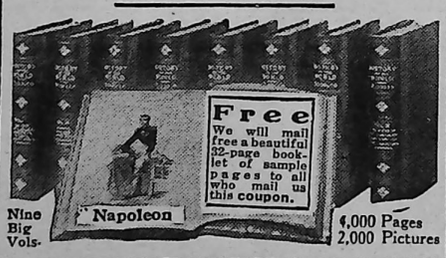
Name.....

Address.....

Business or Employer.....

Ridpath's History of the World

AT A BARGAIN



Nine Big Vols. 4,000 Pages 2,000 Pictures

We will name our *Bargain Price* and *easy terms* of *payment* and mail *free* our 32-page beautiful *sample pages* to all readers interested in our great offer. A coupon for your convenience is printed at the bottom of this advertisement. Tear off the coupon, write name and address plainly and mail now before you forget it. These sets are brand new, beautifully bound in Fabrikoid binding. This is your *last opportunity* to buy before the *price goes up*.

FREE COUPON

WESTERN NEWSPAPER ASSOCIATION (3-20)
140 So. Dearborn St., Chicago, Ill.

Please mail your *32-page free sample booklet* of *Ridpath's History of the World*, containing photogravures of Napoleon, Socrates, Cæsar and other great characters in history, and write me full particulars of your *special offer* to *Popular Science Monthly* readers.

NAME.....

ADDRESS.....

Stop Snuffing

STRONGFORT
The Perfect Man

Sneezing, hawking, spitting and coughing. Why do you have catarrh anyway? You were not born with catarrh—you contracted it. This offensive, unwholesome, disagreeable complaint fastened itself upon you and grew. Nature in trying to prevent more serious consequences due to the congestion in your body, finds an outlet for the accumulated waste, by way of catarrh. You cannot get rid of it the way you are going—sprays, lotions, snuffing powders, drugs and medicines won't stop it. You know catarrh leads to other troubles—serious ones—throat, lungs, stomach, intestines — all become affected. You can never enjoy good health if you have catarrh; you won't be efficient in anything as long as you have catarrh, and it detracts from your personality to be hawking and snuffing around others.

BUILD YOURSELF UP

Be clean—Wholesome—Healthy—Virile. Go at it the right way—Nature's way; no drugs, no medicines, and you banish catarrh from your system. Let me show you how by my method of health building, body developing, called

STRONGFORTISM

Its practice never fails—it builds new tissue, gives brawn and muscle; it invigorates heart action, strengthens kidneys, and makes the bowels move by their own natural strength; it makes every organ in your body pulsate to health. Under this kind of influence, catarrh quits for good, so will constipation, indigestion, nervousness, palpitation, rupture, rheumatism, weak heart, poor memory, physical weakness, vital losses, short wind, and all sorts and kinds of ailments and disorders.

If you are too stout or too thin, flat chested, or round shouldered—Strongfortism will alter it. It will make you grow in vigor and virility—and nervous energy—it will restore your vitality and keep your forces vital. No matter what your condition is now, or what habits you contracted or indulged in—I will show you that you can renew yourself. You want to be strong, healthy—a virile man—you want to be all that a man ought to be and I can and will show you how to make yourself the man that is desirable from every standpoint.

Tell me your ailment and send three 2c stamps to cover mailing expenses and I will send you my book "**Promotion and Conservation of Health, Strength, and Mental Energy**" written for your interest and welfare.

Lionel Strongfort *Physical and Health Specialist*
1181 Strongfort Institute **NEWARK, N. J.**

Music Lessons
UNDER MASTER TEACHERS
At Home

A Complete Conservatory Course By Mail Wonderful home study music lessons under great American and European teachers. Endorsed by Paderewski. Master teachers guide and coach you. Lessons a marvel of simplicity and completeness.

Any Instrument or Voice Write telling us course you are interested in—Piano, Harmony, Voice, Public School Music, Violin, Cornet, Mandolin, Guitar, Banjo, or Reed Organ—and we will send our FREE CATALOG covering all instrumental and vocal courses. Send NOW.

UNIVERSITY EXTENSION CONSERVATORY
6182 Siegel-Myers Bldg. Chicago, Illinois

Copy this Sketch

and let me see what you can do with it. Many newspaper artists earning $30.00 to $125.00 or more per week were trained by my course of personal individual lessons by mail. PICTURE CHARTS make original drawing easy to learn. Send sketch of Uncle Sam with 6c in stamps for sample Picture Chart, list of successful students, examples of their work and evidence of what YOU can accomplish. *Please state your age.*

The Landon School
of CARTOONING and ILLUSTRATING
1251 Schofield Bldg., Cleveland, Ohio

Wanted!

MAIL CLERKS

$1300 FIRST YEAR

Spring Examinations Likely Everywhere

Common education sufficient.

LIFE JOB

Franklin Institute
Dept. M110
ROCHESTER, N. Y.

COUPON

Sirs:—Send me at once, free of charge, Sample Spring Railway Mail Examination questions, list of other U. S. Government positions now open and free book describing them.

Name.....

Address.....M 110

You Need K·I· Shorthand
Simplified Stenography

Whatever Your Calling

The wonderful thing about K. I. Shorthand is the way it helps people in all walks of life. Engineers, chemists, contractors, clerks, mechanics, professional men and women, and farmers, have learned K. I. Shorthand and are enthusiastic in its praise. At last you can learn shorthand **so quickly** and **so inexpensively** that it is **worth your while.**

This new, amazingly simple stenography will enable you to put down conversations rapidly as spoken, take messages verbatim, record board-meeting facts, jot down business-getting ideas, and stand ready to help you every time anything important must be written down fully and instantly. **You do not have to study months** to do this. Just five evenings at home is all that is necessary. Greater speed comes quickly with practice.

Learn in 5 Evenings

K. I. Shorthand is the ideal system for stenographers or secretaries. You can prepare yourself for a position in **weeks** as compared to **months** by the old-fashioned systems—there is so much less to learn and remember. It is the most **practical, concise** and **readable system in the world.** Notes **years old** can be transcribed as readily as when fresh—just like **longhand.**

30 DAYS' APPROVAL

Do not doubt for a minute that you can learn K. I. Shorthand in five evenings even though you may not know the first thing about stenography. It is not a bit remarkable for anyone to learn all the lessons in the system that quickly.

Why put in months of grinding study at some difficult old-fashioned system? **Save Time! Save Money!** Learn K. I. Shorthand, the new *easy-as-A-B-C method* of speed writing.

The cost of the course is lower than it has ever been possible to purchase a stenographic education. Everyone can afford it. K. I. Shorthand is used in Government Civil Service positions and courts as well as public corporations and private businesses.

Simplified K. I. Shorthand dispenses with all special positions, light and heavy shading and other confusing and speed-retarding rules of old systems. You will be delighted.

TRY 2 LESSONS FREE

"Go ahead! I'm getting it in K. I. Shorthand."

You learn K. I. Shorthand in your own home by our mail tuition course. The lessons are fascinating. Experts guide you in quickly acquiring proficiency. **Send for two free lessons and complete information. You may then continue the entire course on a month's approval.**

Here is a complete course—not merely a text-book. Remember, there is no system to compare with K. I. Shorthand in brevity and practicability — and no course giving correspondence instruction obtainable at anything like our price.

We give you a positive guarantee that you can learn or no cost to you. King Institute is incorporated in New York State $100,000.00 authorized capital. Mail the coupon or write a letter asking for free lessons and complete information. Be sure to mention "Popular Science Monthly."

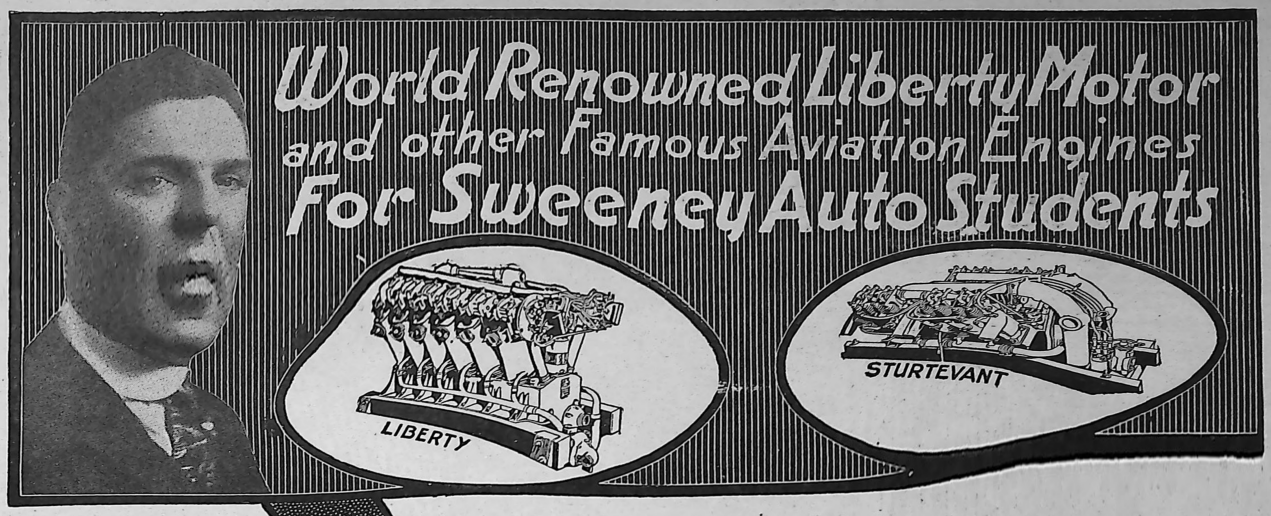
KING INSTITUTE, Inc.
154 East 32d Street, New York, N. Y.
or 8 S. Wabash Avenue, Chicago, Ill.

Please send me the first two lessons in K. I. Shorthand FREE, also full information.

Name .....

Address .....

EK-188



A Personal Message

From E. J. Sweeney

I want to announce for 1920 the most important development in mechanical training that I believe has ever been offered to young men.

We have added to our already magnificent equipment the famous Liberty Motor, the Hall-Scott Motor, the Sturtevant, and the Hispano-Suiza Motor.

As you know, these famous and enormously expensive motors were used by the United States Government in aviation service.

You have all heard about the Liberty Motor. This is a twelve-cylinder V type with overhead valves and overhead cam shaft. It develops 440 horse power and weighs 890 pounds. The Liberty Motor consumes 36 gallons of gasoline per hour on open throttle and 1½ gallons of oil per hour.

Now you cannot be a first class mechanic without being able to handle this motor, and at no other automobile school in the world can you find it but at Sweeney's.

But the Liberty is not all the new aviation equipment we offer for your instruction.

There is the Hall-Scott Six, the Sturtevant Eight, that develops 200 horse power, and also the famous Hispano-Suiza, 120 horse power with 1450 R. P. M.

How many of the best mechanics in your states know anything more than the names of these motors? Yet each and every Sweeney student works on these latest models until he knows them backward and forward.

It is this sort of work by the "Sweeney System of Practical Experience" that turns out real experts—men in demand for big jobs at big salaries.

COME TO THE SWEENEY SCHOOL OF Auto, Tractor and Aviation Mechanics if you really wish to be a trained Expert and to work on the most modern machinery

FACTS ABOUT THE SWEENEY SCHOOL.

Only automobile school in the world owning Liberty Motor, Hall-Scott, Hispano-Suiza, and other government equipment.

Over $1,000,000 actually invested; equipment alone worth over $300,000.

Over 1,200 students and 30,000 graduates.

250 instructors and employes with monthly pay roll of $30,000.

Free medical inspection. No extra charges. Absolutely clean and moral surroundings.

THE SWEENEY SYSTEM

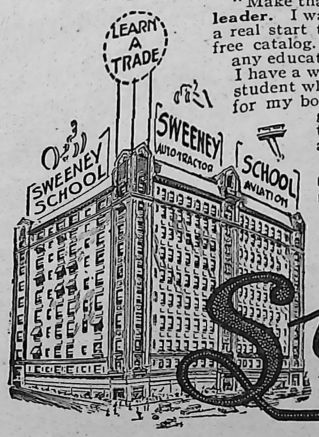
cannot be obtained anywhere else, just as Sweeney's Equipment cannot be duplicated any place else. Learn how to repair or make any piece of machinery by doing the work with your own hands under the personal instruction of experts. Train hand and eye and brain together until you do the job right. This is the celebrated Sweeney System that has turned out over 30,000 graduates and which was approved by the United States Government in sending me 5,000 men to train for army mechanical service. The idea that has built a Million Dollar Trade School and made thousands of men a success in life.

It's the First Step That Counts

"Make that step in the right direction. Come to the recognized **leader.** I want every young man mechanically inclined to make a real start this year. **Begin today** by sending for my big, free catalog. You don't need any previous experience, or any education, because we use tools, not books. In fact, I have a wonderful testimonial from a deaf and dumb student whom I trained in eight weeks. By sending for my book, you incur no obligation, you simply give **yourself** the opportunity of investigating the wonderful possibilities the automotive business offers you.

I say it is the greatest opportunity in the world today, and my free book tells all about it. So mail the coupon NOW and get the FACTS."

EMORY J. SWEENEY,
President



LEARN A TRADE—
Sweeney
SCHOOL OF AUTO-TRACTOR-AVIATION
759 SWEENEY BLDG. KANSAS CITY, MO

COUPON.

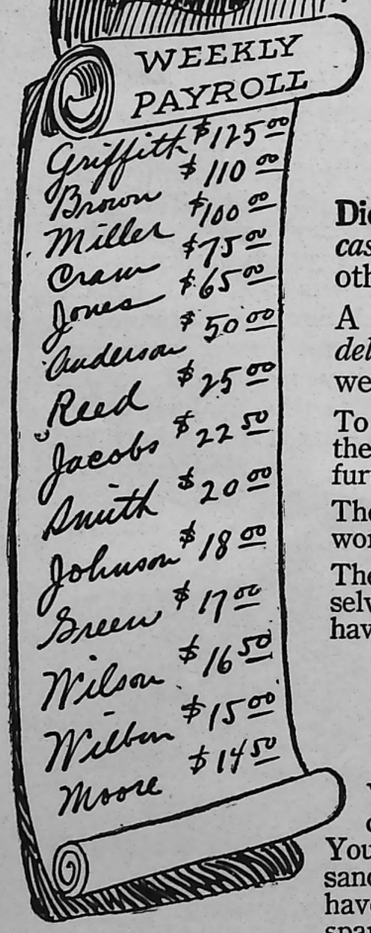
Emory J. Sweeney, President,
759 Sweeney Bldg., Kansas City, Mo.

Send me free your 72-page catalog and Sweeney School News and tell me of the opportunities in the auto and tractor business.

NAME .....

ADDRESS .....

C.O.D.



Did it ever occur to you that all salaries are paid on a C. O. D. basis—*cash on delivery?* It is the only plan on which salaries can be figured, otherwise business would be very uncertain.

A man who is only worth $25 a week cannot expect more until he can *deliver more.* The man who can deliver service worth $75 or $100 a week to the boss expects it—*and gets it.*

To the fellow who has never stopped to think the matter over it must seem that the men who draw big pay are either "lucky" or have a "pull." Nothing is further from the truth, for "luck" and "pull" cut no ice on any payroll.

The amount on your pay check represents in cold figures just how much you are worth on the market—how much you know and *how much you can deliver.*

The men who are at the top of the payroll are there because they fitted themselves to deliver the service they are drawing big pay for. This is all you have to do to increase your pay.

RAISE YOUR OWN PAY

You can raise your own pay by increasing your delivery of service. You can easily do it—just as thousands of American School students have done—by devoting a part of your spare time to practical training. One hour after supper each night will do.

Employers won't show workers how to deliver more—but they are willing to and do pay real money to those who know how to deliver a maximum of service.

We know we can increase your delivery and are willing to guarantee ***our service*** to ***satisfy you*** or we will ***refund your money in full.*** Take ten lessons before deciding whether you wish to continue. You risk nothing, so let us know in the Coupon in which line you want to deliver more—and earn more.

American School of Correspondence
Dept. G-753, Chicago

TRAINING—THE KEY TO SUCCESS

Please tell me how I can qualify for the position marked X.

.....High School Graduate
.....Automobile Engineer
.....Automobile Repairman
.....Airplane Mechanic
.....Electrical Engineer
.....Electric Light and Power Superintendent
.....Hydroelectric Engineer
.....Architect
.....Building Contractor
.....Civil Engineer
.....Structural Engineer
.....Mechanical Engineer
.....Shop Superintendent
.....Steam Engineer
.....Draftsman and Designer
.....Photoplay Writer
.....Business Manager
.....Cert. Public Accountant
.....Accountant and Auditor
.....Bookkeeper
.....Stenographer
.....Fire Insurance Expert
.....Sanitary Engineer
.....Master Plumber
.....Heating and Ventilating Engineer
.....Gen'l Education Courses
.....Com. School Branches
.....Lawyer
.....Telephone Engineer
.....Western Union Courses
.....Wireless Operator
.....Employment Manager
.....Foreman's Training Course

Name.....

Address.....

THE BUSINESS VALUES OF PELMANISM—By George Creel

PELMANISM is able to guarantee advancement and increased incomes for the very simple reason that it gives workers the qualities that employers are hoping for and searching for. Salary is no longer the determining consideration: the main thing is intelligent service.

One of the country's greatest executives speaking recently to the writer, made this statement:

> "For every efficient man or woman, there are ninety-nine inefficients. Stenographers who listen with one ear only, secretaries who can't remember, clerks who keep their eyes on the clock, department heads who are afraid to make decisions of their own, superintendents utterly lacking in initiative and originality—nearly all of them a wool-gathering lot without ability to concentrate on anything but quitting time. Not one in a hundred with any real interest in their work beyond doing as little as they can for the money they get."

The same complaint comes from the trades and professions. Carelessness, laziness, and indifference, instead of intelligent enthusiasm, driving purpose, and quick thinking. A willingness to "stay put" instead of the eager ambition that fairly begs for new opportunities and larger responsibilities. As a result, employers of every kind are the *hunters today*, scouring the country in search of men and women who can "deliver the goods."

The Master Words of Modern Life

INITIATIVE! Imagination! Personality! Good judgment! Originality! These are the master words of modern life, and it is precisely these qualities that Pelmanism develops, strengthens, and directs. It opens your mind for *inspection*, letting you see wherein you are strong, wherein you are weak; and, even as it adds to strength, so does it correct weakness.

Where the average employer makes a mistake is in assuming that inefficiency is willful and premeditated. He is convinced that his employees do not *want* to give good service and to have real interest in advancement. This is true in very few cases. The general run of working men and women have no desire to cheat, most of them have their hopes of holding places of power and distinction, and all of them want to earn more money. The trouble is that they express themselves in *day-dreams* and not in *action*.

When analyzed, this is seen to be a misfortune, not a fault. How can they *listen* when they have never been taught concentration? How can they have *initiative* and *originality*, when our educational system tries its best to turn pupils into parrots and have them all *uniform* in type? How can they have *purpose*, and hold to it, when our life ignores the fundamental truth that the human mind has got to be exercised in order to *be fit* and *stay fit?* As a matter of fact, the majority of workers are doomed to day-dreams because their training, or lack of it, has robbed them of their *mental teeth*. They can't take hold and hang on. The mind, unused to continued effort, tires quickly and jumps from one thing to another like a grasshopper.

GEORGE CREEL

Pelmanism Trains the Mind

PELMANISM does the simple, obvious thing. First of all, it teaches self-realization. Very few people really know themselves. They imagine they are this or that, and blunder through life the victims of their own ignorance. In the second place, Pelmanism trains the mind, exercising it scientifically, meeting its new strengths with new tests, until, at the end, there is perfect balance, full power, and an amazing endurance.

Another great mistake, and one made generally, is the assumption that business is a purely *mechanical* process.

There is, on every hand, a general, well-grounded belief that business calls for the *hard* qualities, not the fine ones—that it is a thing of routine, not a drama of inspiration.

As a matter of fact, modern business is an organization as interesting as it is vast, and its operations make steady and imperative demands upon every mental quality. Not a day passes that its generals, captains, and corporals are not called upon to bring the functions of the mind into instant operation at high pressure. Routine efficiency is not enough.

The call is for the quick, leaping brain that is able to create Ideas, to find fresh viewpoints, to make decisions as logical as they are swift, and to manufacture opportunities, instead of waiting for them. Imagination, courage and resourcefulness are as much tangible assets as stocks and bonds, for business today is not a "church social," but a *battle*.

Pelmanism Develops Business Power

BUSINESS is the *Great American Romance*. It is business that has harnessed the stream, tunneled the mountain and the river, turned deserts into orchards, and made the United States *the* world power in one hundred and forty-three years. It calls for the *best* and it *deserves* the best. It is this *best* that Pelmanism develops, trains, and directs.

Business needs the *whole* mind, not just part of it. It is often the case that a man of vision, forethought, initiative, resource, courage, and confidence is forced to confess that he has "no head for detail." On the other hand, masters of detail "fall down" when the big problem comes along.

The fault in each case is an incompletely developed mind, a mind which has been developed on one side but not on the other.

The Pelmanist finds no difficulty in assimilating detail and he rises supreme when big issues confront him. His training gives him the balanced mind, the alert mind, the mind that is receptive and responsive. And that is just the type of mind which achieves success with almost miraculous ease while other men lag behind, puzzled, confused, and inert.

Go Forward or Go Back

THE appeal of Pelmanism is neither narrow nor specialized. The beginner will find the secret of promotion in it. The veteran "job holder" will get from it new courage, self-confidence, and a resourcefulness that will lift him above his fears and out of his ruts. Executive heads will discover that Pelmanism takes up "mental slack," tones up the mind processes, and acts as a tonic to vision, decision, and imagination. Business permits no stand still. Those who do not *go forward* commence to *drop back*.

This great course comes at a great time. Never before in the history of American business were such chances open to intelligent ambition. Old barriers are down, the gates of success swing wide, and the ranks of the country's workers are being *combed* for the "right sort."

(Signed) GEORGE CREEL.

Make Yourself That "Right Sort"!

MAKE yourself a Pelmanist. Do for yourself what 400,000 other men and women have done—put yourself in a mental position not alone to grasp opportunity when it comes, but to *make* opportunity come to you.

Pelmanism is neither an experiment nor a theory. It has stood the test of twenty years. Its students are in every country in the world. Its benefits are attested by hundreds of thousands of men and women in all walks and conditions of life.

Pelmanism is taught entirely by correspondence. There are twelve lessons—twelve "Little Gray Books." The course can be completed in three to twelve months, depending entirely upon the amount of time devoted to study. Half an hour daily will enable the student to finish in three months.

Send for "Mind and Memory" Today

THE booklet is free. Fill out and mail the coupon or a postcard—today—now—before you forget it. Take your first lesson in the rudiments of Pelmanism—don't procrastinate—decide to do a thing and then *do it—now*, not later. Write to Pelman Institute of America, Suite 325, 505 Fifth Avenue, New York.

PELMAN INSTITUTE OF AMERICA,
Suite 325, 505 Fifth Avenue, New York N. Y.

Please send me, without obligation, your free booklet "Mind and Memory."

Name.....

Address.....

.....

All correspondence strictly confidential. Pop.Sci.Mch.

WHITE OWL

3 for 25¢

9¢ for 1

Value!

With prices climbing it's a relief to know that it is still possible to get so fine a cigar as White Owl at a reasonable cost.

No doubt you already know why there is such good value in the White Owl. The tobacco is of fine character and is very carefully cured by experts.

The long Invincible shape with its tapering end, gives the White Owl the appearance of a much more expensive cigar.

In addition, White Owl benefits from the great resources and long experience of the General Cigar Co., Inc. This fact alone guarantees you good value. If you are looking for good value, we recommend White Owl, a mild, fragrant cigar.

General Cigar Co., INC.

DEPENDABLE CIGARS

119 West 40th Street
New York City

Popular Science Monthly

Waldemar Kaempffert, *Editor*

March, 1920; Vol. 96, No. 3
25 Cents a Copy; $3 a Year

Published in New York City at
225 West Thirty-ninth Street

A Flying-Boat that Sheds Its Wings

Changing from bird to fish if compelled to alight at sea

WHEN you fly to New York from England across the Atlantic ocean, everything depends on the engines. So long as they run you skim the clouds in safety. If they stop, down you must glide to the sea. Motion is the secret of an airplane flight—incessant motion.

Do you remember Hawker's mishap? Do you remember how nearly he lost his life in a heavy sea, because a passing tramp steamer found it difficult to reach him? To be sure, his was a land machine—doomed if ever it was compelled to alight on the heaving billows.

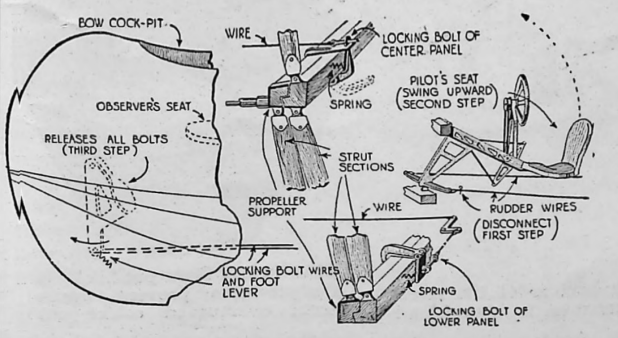
The transatlantic airplane of the future will probably be a flying-boat. If its engines fail, it will alight on the surface of the water and float. The wings will then become a handicap, particularly in a storm. A sailing ship in a storm scuds along, either close reefed or under bare poles. The enormous expanse of wing of a flying-boat as it floats may imperil the passengers. Why not shed them altogether? That is the solution proposed by Mr. Glenn H. Curtiss and one of his engineers, Mr. William L. Gilmore.

Examine the accompanying drawings and you will see how Mr. Curtiss and Mr. Gilmore could rid a flying-boat of its useless wings.

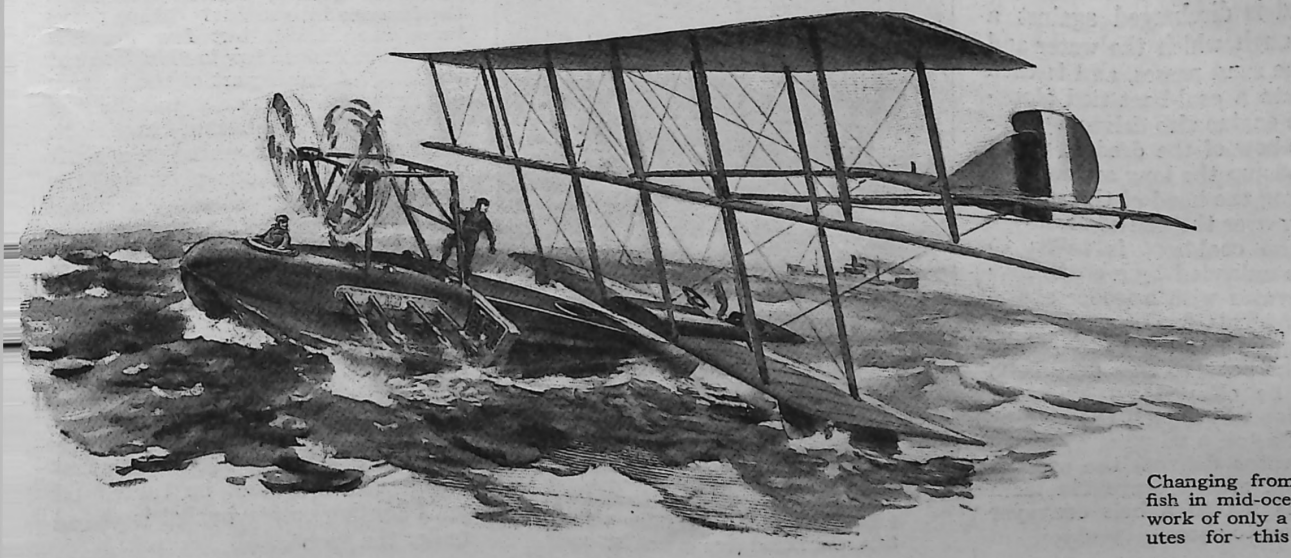
In the first place, there is a very staunch, seaworthy hull, provided with bulkheads and water-tight compartments. In that hull an engine is mounted which drives aerial propellers; there is also an auxiliary engine, which drives a water propeller.

The wing structure to be shed consists of a triplane, secured to the back of the hull by means of a saddle. Pull a lever and the saddle is released so that the wings and outrigged tail (supported from the wing cell only) slides back on rails from the stern of the boat.

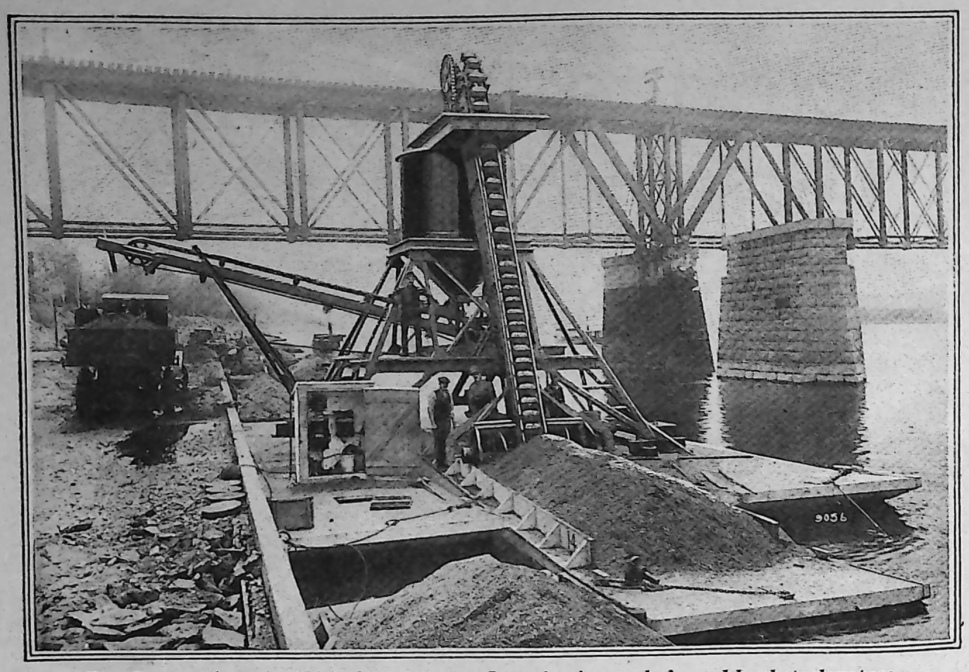
The wings are to be shed with the aid of the aerial propellers. But suppose the engine is dead? The wings can nevertheless slide back because of the inclination of the trackway and the propulsive effort derived through the water propeller. The wind literally blows the entire wing structure away when it is released, leaving the boat free to ride the storm.



To shed the wings the pilot in the rear cockpit disconnects the rudder wires, pulls up the wing controls and pilot's seat to a position above deck, and climbs to a position of safety. The observer forward unfastens the holding bolts and the wind from the propellers blows the wings overboard



Changing from bird to fish in mid-ocean is the work of only a few minutes for this biplane



The flat coal-boat is slid in between two floats having a chain-and-bucket elevator; the coal is carried to a storage bin above and fed to a belt conveyer running to shore

Mining Coal from the Bottom of a River

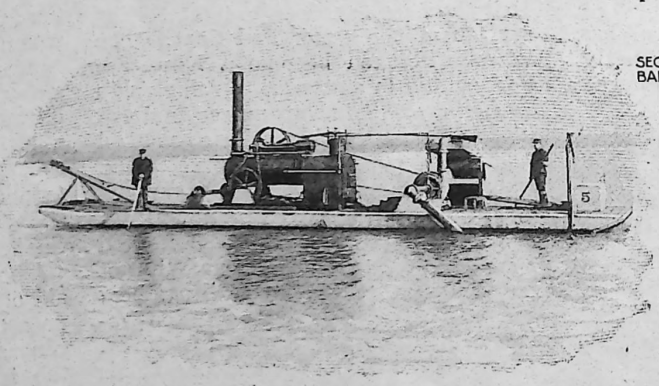
IN the anthracite coal regions of Pennsylvania, a great deal of fine coal from the culm banks is washed down the streams at times of flood, forming extensive beds of coal. This fine coal can, with modern methods of combustion, be used very satisfactorily in steam plants.

Along the Susquehanna River coal fleets are very much in evidence; long flat boats with stern wheels, for navigating the shallow waters, move the dredges and coal-boats. Each dredge, as shown in the illustration at the right, is equipped with a horizontal engine and boiler which drives a rotary pump that sucks the coal up from the bottom of the river.

The coal is discharged against a screen through which the water and most of the sand passes, and is then dropped into a coal-boat tied alongside. The engine also drives a windlass at the bow of the dredge, which slowly winds up the long anchor rope so as to drag the head of the suction pipe slowly over the bed of coal.

When the coal-boat is taken to shore, it is unloaded by a chain-and-bucket elevator with a feeder at the lower end. This feeder sweeps up the coal across practically the whole width of the boat, so that very little is left to be cleaned up by hand. The machine will unload the coal at the rate of a ton a minute.

The elevator delivers the coal to an overhead steel storage bin from which it is fed to a belt conveyer running over to shore.



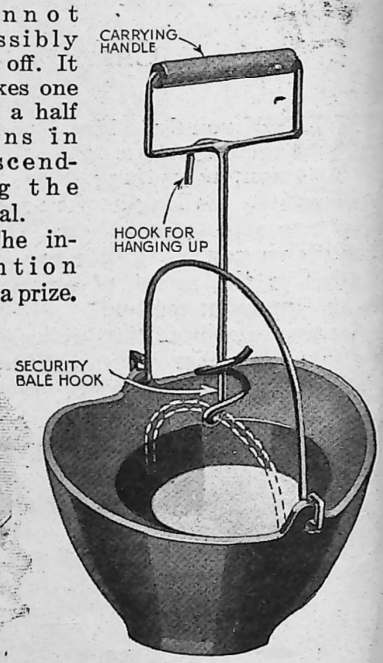
This dredge sucks up coal from the bottom of the river; then the coal is thrown through a screen on to a coal-boat

A Hook that Holds the Solder-Pot Securely

"LOOK out!" shouted one of the linemen who were occupied with a soldering job. The next moment the solder-pot upset, and the man who was holding it narrowly escaped a bad burn.

William Nieswinter, a foreman in the employ of the Commonwealth Edison Company of Chicago, saw this incident happen so often that he devised the safety pot-hook shown in the picture. The hook part is made in the form of a spiral. The weight of the pot carries the bale to the bottom turn, and once there it cannot possibly slip off. It makes one and a half turns in descending the spiral.

The invention won a prize.



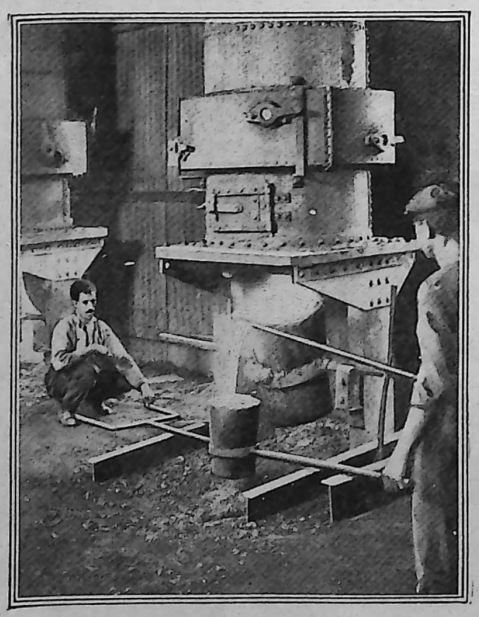
This safety-first pot-hook is designed to prevent burns from overturned solder-pots

The New Iron Bucket

WHICH is the most efficient way of getting molten iron from the furnace into molds? Many ways have been tried, but few survive. One of the chosen few is illustrated at the left. A small part of the bottom of the furnace drops out and the iron pours into a large bucket beneath it.

The bucket is mounted on a shaft that can be made to revolve; thus the bucket is easily tilted. A small bucket is placed in front of the large one and the iron is poured from the large to the small. The men carry away the small bucket, fill the molds from it, and by the time they get back the large bucket is full again. Two men are thus able to fill the molds rapidly and the process is continuous.

In most furnaces, when the bucket is full the flow must be turned off until another empty bucket is placed under the spout.

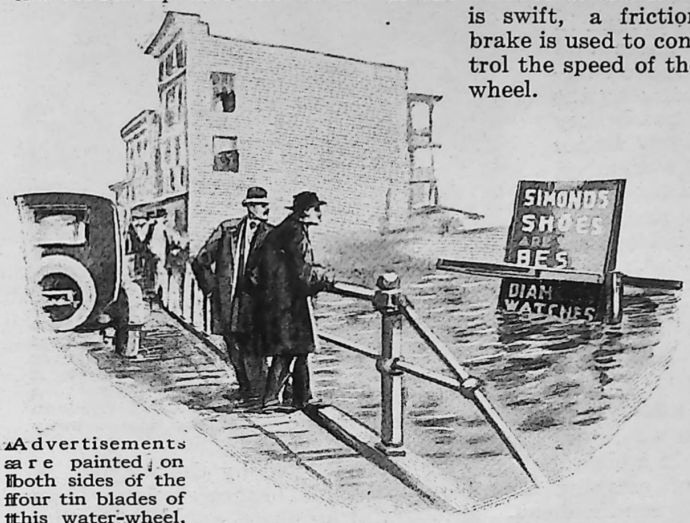


The molten iron pours from the furnace to a large bucket which tilts the liquid into a smaller one

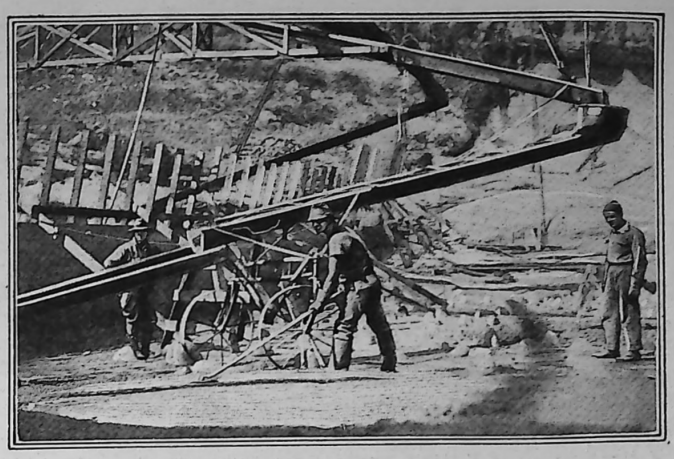
Advertisements on a Water-Wheel

THE water-wheel has gone into the advertising business and finds the work much easier than furnishing power to machinery. Advertisements are painted on both sides of each blade. The wheel turns over—propelled by the current of the river—and the wet advertisements shimmer forth in turn, so that all who pass may read.

Four posts are driven into the river-bed, and the water-wheel is mounted on and above them so that the tips of the blades dip into the water. If the current of the river is swift, a friction brake is used to control the speed of the wheel.



Advertisements are painted on both sides of the four tin blades of this water-wheel, which attracts considerable attention from passers-by



The end of a concrete chute is mounted on a bicycle so that it can be pushed into any position desired

A Concrete Chute on a Bicycle

A CONCRETE chute goes for a bicycle ride! Sounds strange, doesn't it? But consider the problems with which a concrete chute is confronted. It must move its delivery end from place to place as the work progresses. Why not use a bicycle for the job?

This scheme was put into effect in the construction of the Gibraltar dam, near Santa Barbara, Cal. The two wheels were taken from an old buggy and were mounted on a frame made up of scrap iron and odd pieces of old pipe. The chute was fastened to the frame. The wheels were bolted so that they could be turned in any direction desired.

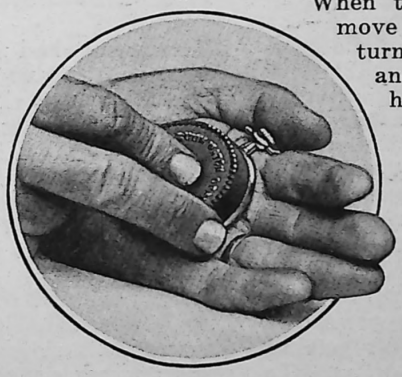
When the workmen wished to move the chute they simply turned the wheels to suit and pushed the bicycle by hand.

Wire Your Bathrobe and Keep Well

"IT'S cold!" you chatter as you come home worn out from a hard day's work. What you need is invigorating treatment, and you may easily obtain it by putting on an electrically heated bathrobe.

Such a robe has copper wire woven in with the cloth so that no two sections touch each other, thus preventing short circuit when the wire is connected to an electric circuit. The bathrobe is provided with a thermostat for regulating the temperature.

The bathrobe is the invention of Mr. Charles Cann, of Salt Lake City, Utah. It also comes in the form of a blanket. Mr. Cann invented the device in an attempt to cure his wife of rheumatism; and he tells us that it was a great success.



Refractory watch-cases yield to this form of persuasion in short order. A vacuum cup affords a good grip

This bathrobe is wired; by connecting the wires with an electric socket you will find yourself greatly invigorated as the electricity warms your blood

She suffers from rheumatism, but expects to be cured soon, for she is wrapped in an electrified blanket; the wires are carefully woven in

A Vacuum Cup to Open Tight Watch-Cases

"SAY, Tom, can you open this watch-case? It's stuck tight." It was a repair man at a watchmaker's who spoke. A screw-back case was stuck and he could not get a grip on it with his hand.

To cope with cases like this a vacuum cup has been invented by Hugh C. Danner, of Martinsburg, W. Va. It is reproduced above.

The cup is made of soft rubber, and has a roughened grip around its upper rim. To open a watch, the rubber opener is pressed against the back of the case. By pressing in the top of the cup a partial vacuum is created, which causes it to adhere strongly. In this way an excellent grip is afforded and the case can then be unscrewed without any further trouble.

Fighting Fire Under Water

Water, water everywhere, but never a drop to put out the fire that threatened the lives of two divers

By Francis Arnold Collins

FEW firemen have ever faced so appalling a danger as did the deep-sea divers who found themselves trapped far below the surface of the water in a burning wreck. The submerged hull in which they worked was filled with compressed air and the abundance of oxygen made the flames spread with abnormal rapidity. Though they were literally buried under water, there was no time to wrench open the hull and let it in. Should they abandon the job?

From the first the work of salving the wreck had proved extremely difficult. The ship had gone down in quiet but deep water, and every effort to raise her with pontoons had failed. It was finally decided to close her hold and some of the superstructure and to blow out the water by compressed air.

The ship had been injured in a lower section of the hull and the work of plugging her hold was less difficult than might be imagined. Like a bottle upside down in the water, it didn't matter so much if there were a small hole or two in the lower side—the water would enter only a little way. But the holes in the top would let out any air forced in and cause the trouble.

Several days had been spent inserting strips of oakum in the openings to stop the leaks and make the upper sides air-tight. Finally the air-pumps were started. Several hours of pumping, however, failed to bring up the sunken ship.

"She leaks," decided old Bill Andrews, veteran at the pumps. "The water's gone out of them upper cabins all right, but when the air gets to pushin' the water on down into the hold, and out the bottom of the ship—why, one of them cabins is leakin' air just enough that the pressure keeps goin' down and the water don't back out only so far. We can't raise the ship unless all the water goes out. Them leaks is got to be fixed."

This statement, though ungrammatical, was entirely correct. Two experienced divers were selected to go down into the air-chamber and investigate. They wore full diving-suits.

The divers reached the hull in safety, made their way through the hole in the bottom and up into the superstructure to the point where the air had driven the water out. Candles were lighted and they started on their tour of inspection. The tiny flame was needed not so much for illumination as to show the presence of a current of air. If a leak had sprung in one of the cracks, then when the candle was held near it the flame would blow the way the air was going—out the leak, and would indicate at a glance the location of the leak.

Clumping laboriously around in their leaden-weighted shoes and heavy suits, the men moved forward, holding the candles to the cracks. Slowly and cautiously they worked, for no one knew better than they that the air-chamber, far below the surface of the water, was ripe for a bad fire. The compressed air had dried out the inflammable materials. An enormous amount of oakum had been used in filling the seams, and the ragged ends of oakum are highly inflammable. Once started, a fire under such conditions would spread with rapidity. Even under ordinary air-pressure the oakum would quickly fan the merest spark into a blaze.

Suddenly a draft of escaping air caught the flame of the candle ahead. Before the diver could draw back, it had leaped to a frayed end of oakum several inches away.

"Fire!"

The worst had happened. There were tons of water above, below, and all around, but no time to wrench open some part of the roof or sides of the cabin and let it in. The flames were spreading with terrifying speed. Without thought of self, the men, driven to the most primitive method of defense, tried to beat out the fire with their heavy mits. Had they forgotten in their excitement another danger that threatened? The smallest hole burned through the air-tight gloves meant certain death—suffocation from the smoke that would pour into the inflated suits, or death by drowning should they attempt to leave the air-chamber. And still they fought, inviting death at every blow.

The dark chamber was lighted only by the fitful flames of the burning oakum. The heavy diving-suits made the work extremely difficult. The movements of hand and foot were slowed down by the weight. A blow that would beat out a flame in an ordinary atmosphere would not suffice here. Desperately they pounded and stamped, working like men in a nightmare who try to escape from peril but are held back by an invisible force. Bit by bit they gained on the swift, fierce flames, which were fed by the light oily oakum and the excess of oxygen in the air. At last pluck won. Under the frantic slapping and stamping the last spark smoldered out.

Then only did the divers think of retreat. Their gloves, though badly singed, were fortunately intact. Slowly they retraced their steps through the dark winding passages, until they reached the free water. With a jerk, they signaled to be drawn up.

As they crawled over the rail of the ship above, a strong smell of burnt rubber still lingered about them. Once safe above the ground, or rather the water, they sat down for a quiet smoke. Old Bill Andrews labored up a hatchway.

"Hello, what's up?" says he, hunting for his favorite oilcan.

"We are," was the laconic reply, "and if you don't mind we'll stay up."

Suddenly a draft of escaping air caught the flame of the foremost candle, and before the diver could draw back, it had leaped to a frayed end of oakum several inches away

Clad in heavy, clumsy diving-suits, the men were sent down to search for the air leak in the sunken hull

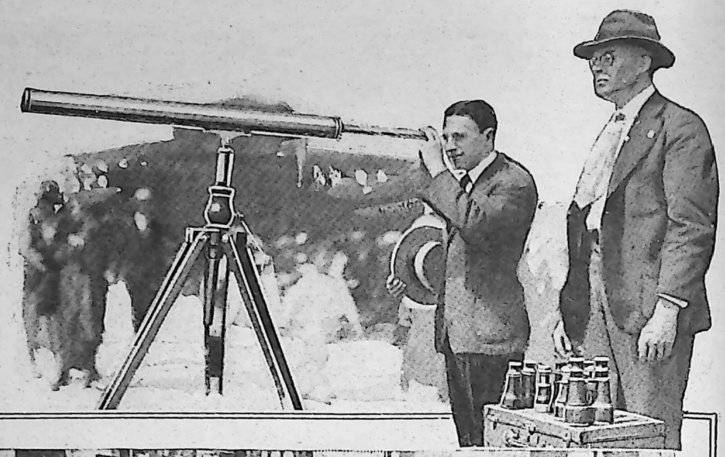
They Faced Death by Fire at the Bottom of the Sea

The hull of the sunken ship was filled with compressed air, and the abundance of oxygen made the flames spread with appalling rapidity. Though they were entirely surrounded by water, there was no time to break through the roof or sides of the cabin. But the men would not desert their job. Weighed down by their clumsy diving-suits, which made every slightest movement an effort, they fought back the flames with their hands. One small hole burned through their inflated rubber suits meant death by either suffocation or drowning

How to Earn a Living

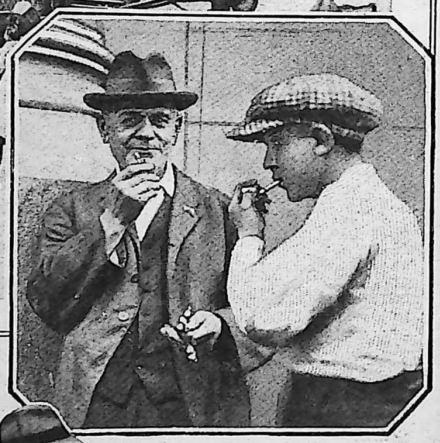
If you don't like your job, why not try one of these?

Photographs © Press Illustrating Service



This man has mounted a telescope in Battery Park, New York, and he charges five cents a look. By day the people look at the sun and by night at the moon

From street to street he travels with his merry-go-round, charging one or two cents a ride; the children ride the small horses that go round and round while a tin-panny piano plays a tune



He whistles for a living; yes, he really does. And when you hear the birdlike tune you promptly buy one of his whistles. He stands on a crowded corner and works industriously all the day long

Collar buttons are this man's specialty; he stands on the corner buttoning and unbuttoning his collar while a crowd gathers round and watches him. He demonstrates the superiority of his particular collar button, and sells many like it

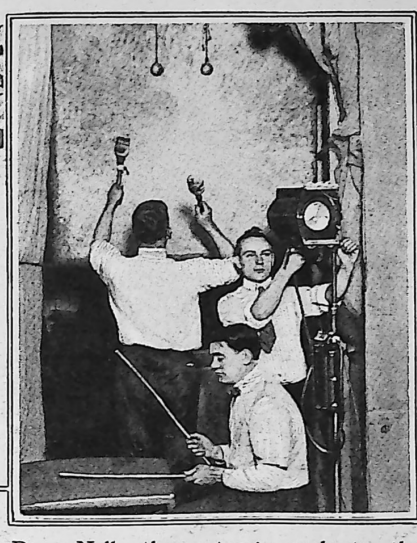
"Umbrellas to mend!" This man shouts through the streets while he carries on his back the mending-machine. His customers are many, for umbrellas, like everything else, have gone up, and it's much cheaper to have your old one mended than to buy a new one

Noise for the Silent Drama

Parrots shriek, lions roar, airplane motors hum — all from the orchestra pit

Photographs © International Film Service

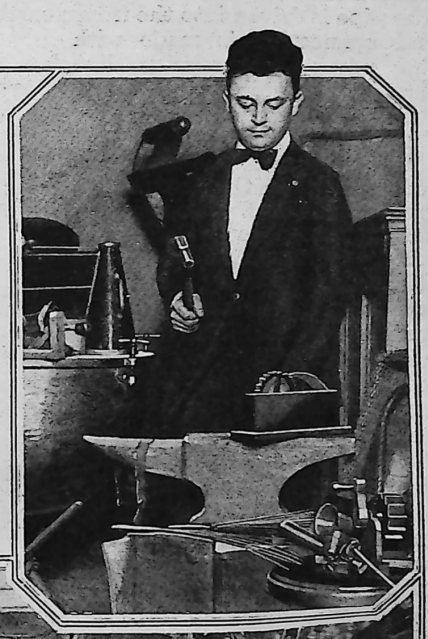
He's got his hands full of instruments for imitating birds. When Mary's pet gets a close-up, be it a parrot or a canary, Mr. Manne reaches over, picks up an instrument, and soon the theater is filled with the singing or chattering of birds, as the case may be



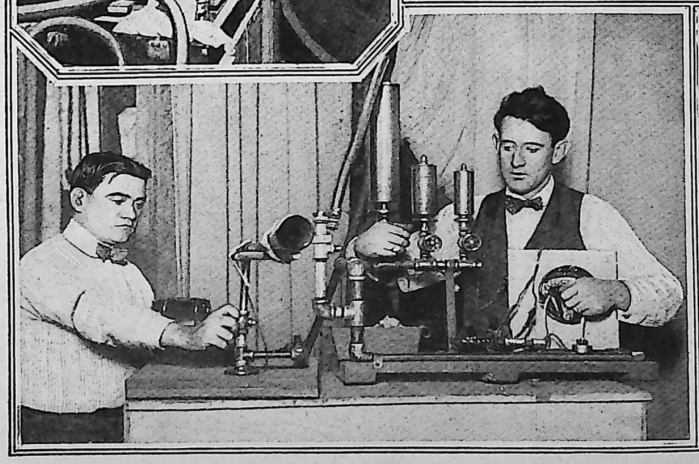
Poor Nell, the outcast, sank to the ground exhausted; the rain poured down, the lightning flashed, and the thunder growled ominously. And this is what happened behind the screen: one man made the thunder, another flashed the lightning, and a third imitated the rain

They look like frying-pans and saucepan lids, but they are only some of the gongs that hang on the wall; Mr. Manne sits with his back to them and simply reaches up when Chi Chu, the Chinese dope dealer on the screen above, pounds for his servants

And the villain still pursues her—on horseback; whereupon Mr. Manne gets out his two imitation hoofs and plays a tune with them on a board, keeping time with the horse on the screen

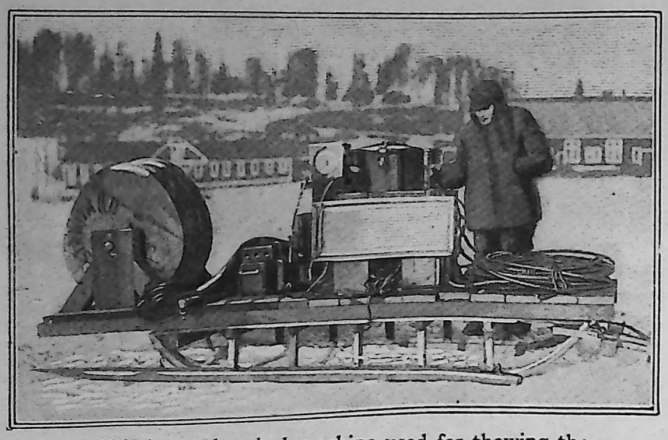


The musical director can order the "Anvil Chorus" any time he wants to; Mr. Manne keeps a hammer and a good sized anvil down in the pit with him all the time



Train whistles and automobile horns are not easy to imitate; an electric circuit is involved and two men are usually needed to run it; the man to the left is getting ready to let off a shrill one

You might think this a hardware store; in reality it is the drummer's end of the orchestra pit of one of New York's largest moving-picture houses; Mr. Max H. Manne, the man in the case, performs on over three hundred instruments



This is an electrical machine used for thawing the ground in Alaska, where a railroad was to be built

Thawing Ground by Electricity

AN electrician connected with the Alaskan Engineering Commission has fitted up a thawing-machine that can be used to prepare the ground for pile-driving or excavating wherever electric power is obtainable.

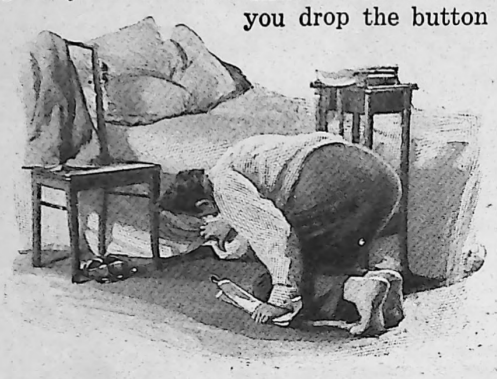
A steel pipe, equipped on its interior with a resistance coil, is fitted at one end with a sharpened steel point and at the opposite end with a solid steel driving-head. There is an insulated electrical connection with the enclosed resistance coil. The pipe is driven into the frozen earth to the desired distance and connection is made with the power transmission line through a portable transformer station mounted on a sledge, as shown in the illustration.

The voltage of the current is reduced and the amperage greatly increased. The resulting heat generated in the resistance coil is communicated to the enclosing steel of the pipe, and radiating therefrom thaws the surrounding earth. The water from the thawing ground cannot reach the resistance coil and hence its temperature is not reduced. In a comparatively short time the ground is sufficiently thawed to permit the withdrawal of the driven pipe and the introduction of a wooden pile, which is readily driven to the desired depth.

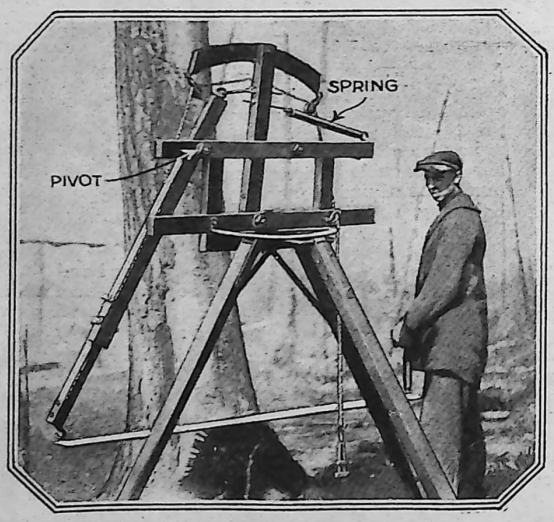
Where's the Collar Button?

DOWN on his knees, the man in the picture below looks under the chairs, under the table, under the bed. Is he hunting for a burglar? No, oh no! He is only looking for a collar button that slipped out of his fingers and rolled away. In his haste to find it he took his clean collar with him and is wiping the floor with it.

Such disasters are not necessary if you use the collar button recently invented by Frank Cadden of Chicago. It comes in shape no bigger than an ordinary collar button, but it is heeled with rubber and has a decided center of gravity due to a lead disk that fits into the base. Should you drop the button the lead weight would insure its landing right side up and the rubber base would keep it from skidding. Thus you would find it at your feet.



He's looking under the bed for his collar button; if he had used one of the new weighted buttons it would have fallen at his feet and stopped there



One man can work this saw; he pulls on his end and a spring jerks the saw back

Lighting Up the Tight-Rope Walker

THE tight-rope walker flashes on and off as if he were a lighthouse. At each step the buttons on his breeches flash on and off—they are colored electric light bulbs.

His shoes have metal toes and heels that close an electric circuit every time the walker has both feet on the rope at once. Wires run up his legs to the buttons and his feet are enclosed in non-conducting shoes.

The tight-rope is wired in sections so that alternate sections are a continuation of each other.

The wire that carries the current is wound around the rope and is so arranged that there are many contact points.

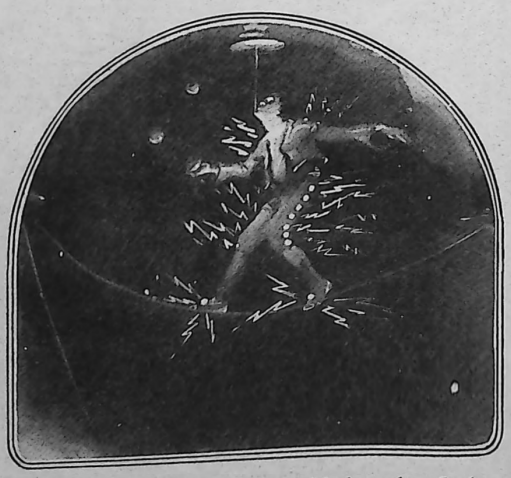
The Spring Is the Other Man on This Saw

IF you will look toward the bottom of the photograph above you will see a saw attached to the end of that bar on the left. The center of the saw is embedded in the trunk of the tree and the opposite end rests in the hand of the workman.

He is sawing down the tree by himself—or, rather, with the aid of a spring. As he pulls on the saw the anchor-shaped device on the top of the stand is swung unwillingly to the left—the spring tries to hold it back. As the man finishes a stroke he releases the handle of the saw and the spring promptly contracts, making the cut in the opposite direction.

This saw was invented by Charles A. Moore, of Kinney, Minn. It happened this way. He was a boy at the time of the Civil War, living in Virginia, and when the men left to go to war he had to hold down a man-sized job in the fields, and take a turn at the wood-pile "with an old wabbly bucksaw and a dull ax."

Many years later he drifted back to his old boyhood home, and there, to his great surprise, he found the same old ax and saw in operation. Astonished at the lack of progress, he built the saw shown above.



The electric light buttons on his breeches flash on and off, for metal heel and toe contacts are continually opening and closing a circuit

© International Film Service

Raising bees in order to conserve the sugar in flowers that is ordinarily wasted

Rope Shoes Made by a Sailor

THE Peabody Museum at Salem, Mass., harbors a pair of rope shoes. They were worn many years ago by a sailor on a whaling vessel. He used them to keep him from slipping on the greasy decks. The shoes, which are now badly discolored, were originally made of manila rope.

They are shaped very much like the regulation Indian moccasin and look as though they were easy to make. They might still be useful on the modern steam whaler, for whale oil has lost none of its ability to make the deck of a vessel a very good substitute for a skating-rink.

These rope shoes were worn long ago by a sailor on a whaling vessel to prevent slipping on the oily deck

© International Film Service.

A red light on his head and white lights on his shoulders guide the traffic

Better Keep Bees

SUGAR is increasingly scarce and expensive; yet right around us there is an almost unlimited source of it going to waste—the flowers. The bee will gladly gather it for you if you provide it with a hive.

Students at Harvard College have built themselves simple hives like the one shown above and have got as much as thirty pounds of honey from a hive in the rush season.

Of course, some honey should be left for the bees.

A Lit-Up Policeman

WHAT'S that red light ahead? You wonder. It's in the right place for a traffic post, but it moves! As you reach the corner you see that the light is on a policeman.

A lit-up policeman is shown above; he has a red light on his head and two white lights on his shoulders. He wears a pair of long white gloves on his hands, two white straps across his chest, and carries two batteries in his overcoat pocket.

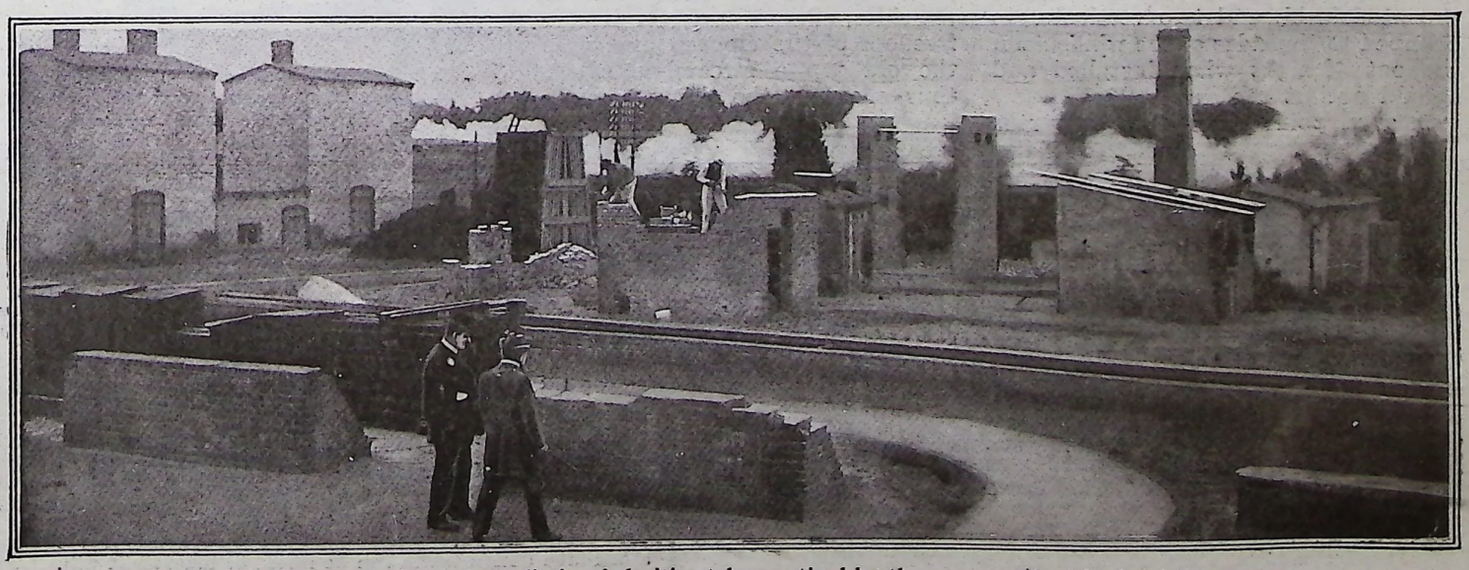
This particular policeman regulates traffic at a corner in Boston.

Testing Building Materials by Fire

IF you wish to ascertain whether a building is fireproof, set it on fire. This method is thoroughly reliable but unsatisfactory for obvious reasons.

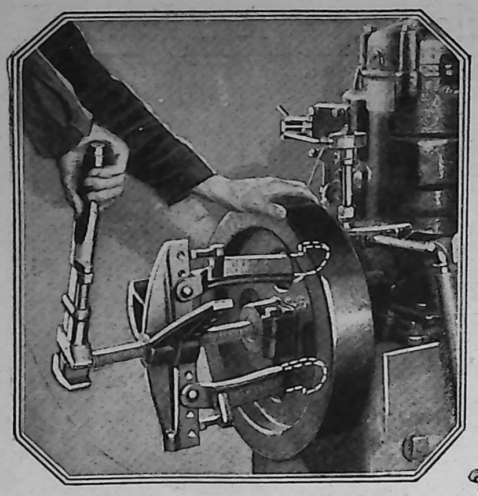
The modern method is illustrated by the accompanying picture. In a large open space small buildings are erected from the material to be tested or incorporating such material under conditions similar to those surrounding them in actual practice. Then they are set on fire and allowed to burn for a certain period. The behavior of the material during the fire is carefully observed and its resulting condition noted.

Iron, steel, stone, brick, cement, and other building materials are thus tested. By the same method the effectiveness of fireproofing materials is practically demonstrated and information collected as to the effects of extreme heat on the supporting power of iron, steel, concrete, or stone columns, beams, trusses, and other structural units.



This shows a place where incendiarism is legitimately practised by the proper authorities for the purpose of testing the resistance which iron, steel, stone, brick, cement, and other building materials have to fire

Making Repairs Without Getting Under



The puller with its spiderlike framework grasps the flywheel and forces it from the shaft by means of set-screws which are tightened

To Remove Flywheels

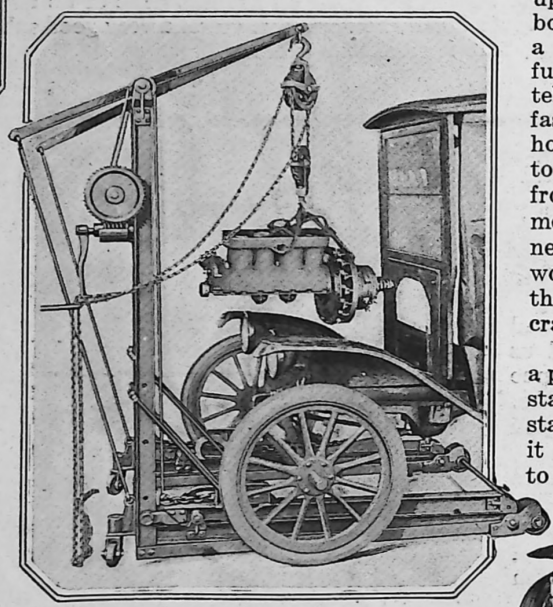
THE simple puller shown above was devised to remove an automobile or motor-boat engine flywheel.

The hooked rods are pivoted to the spider arms and their other ends made to grasp the flywheel in the most convenient location; the set-screws on the rods are then tightened up against the spider arms; the center bolt is screwed down through its boss until it touches the end of the flywheel shaft and the bolt is then turned with a monkey-wrench until the flywheel is forced off.

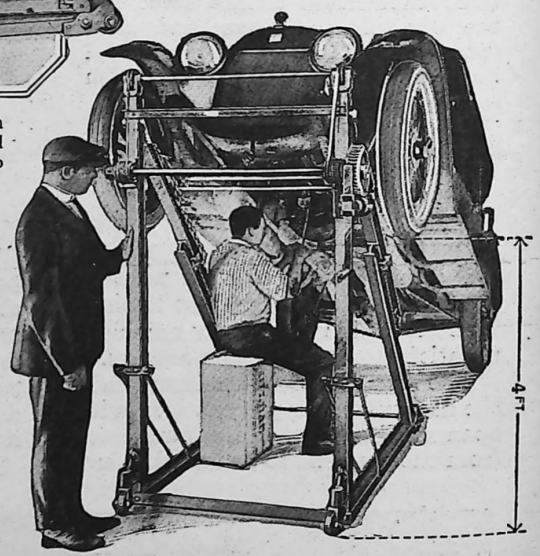
A MAN in Chicago made a study of the conditions met with in the maintenance of the six and one half million automobiles and motor-trucks in the United States, and found that fifty per cent of the repair work is done from underneath the chassis. He immediately devised a hoist to lift either end of a car or truck three or four feet off the floor so that the repairman can work on the parts underneath without lying on his back. Furthermore, with this machine an engine may be overhauled without taking it from the car; for by removing the lower half of the crank-case and lifting the front end of the car, the main and connecting rod bearings can be examined just as easily as if the motor were removed and placed on an engine stand.

The machine consists of two metal uprights and two horizontal arms, both suitably cross-braced to form a self-supporting stand, which is further braced by two additional telescoping or oversliding arms fastened to the far ends of the two horizontal members and to the tops of the vertical bars. The front end of the vehicle is lifted by means of cables attached underneath the axle, the cables being wound up on drums hung from the vertical bars and operated by crank handles.

A crane-boom attachment forms a part of the outfit and may be installed in a few minutes' time. The stand is mounted on rollers so that it may easily be moved from job to job as desired.



With the addition of the boom arm it can be used as a crane for lifting all sorts of things in a repair shop



The machine so elevates the front of the car that the mechanic may easily work under it without having to lie down

The One-Man Ford Top Is Here

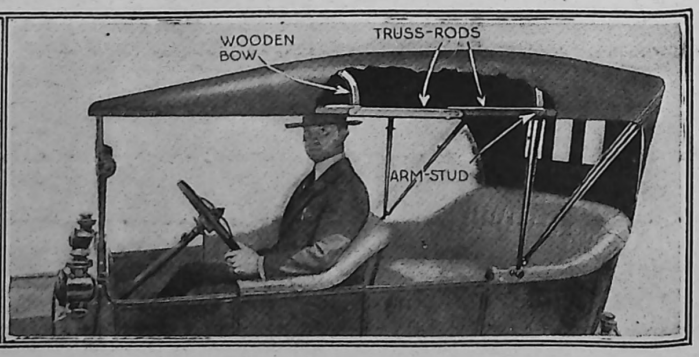
NOW comes a converter to change the old-fashioned Ford top into a one-man design. The old top and all of its fixtures are retained except the unsightly front bow sockets, which are discarded.

The converter connections, which consist of two side truss rods extending from the rear bows to the front of the windshield, and two vertical rods clamped to the sides of the windshield, are out of sight when installed and should outlast the car itself.

A good point about this converter equipment is that it costs less than ten dollars and may be installed in about an hour's time without the use of any special tools.

It has a number of improvements over the old top; it can be manipulated by one person; makes it easier to enter or leave the car; permits an unobstructed view at the sides; allows the driver greater freedom of the elbows; and gives the old top a streamline effect, thus making the body appear longer.

Here is the old style top, where one has to duck to avoid the cross-piece when admiring the scenery or getting out of the car; certainly a rather awkward arrangement



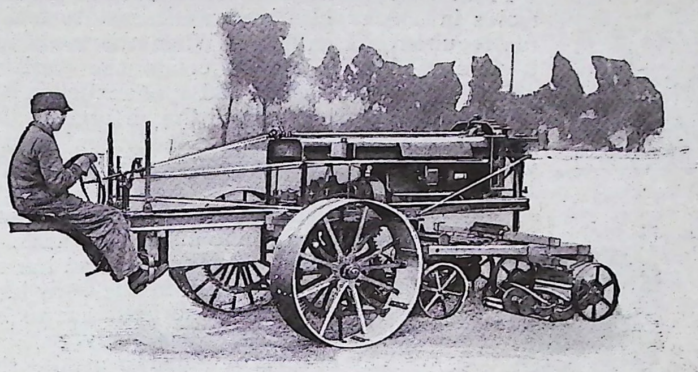
This contrivance attached to the Ford top converts it into a one-man design which can be raised or lowered at will. How clean-cut this is compared with the car at the left

At Home Even on the Links

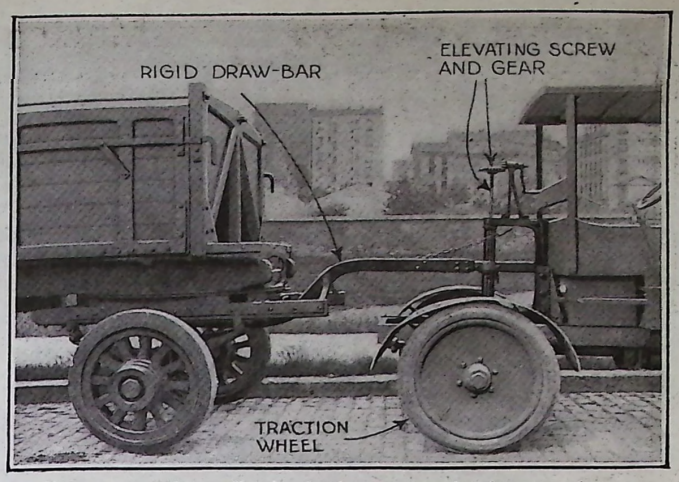
NO more will Colonel Bogey be hindered and tripped up by the imprints of horses' hoofs on the golf links, nor will his long drives be found nestling snugly in the little hollow where stepped some heavy-weight horse while pulling the mower.

It is now the fashion for golf clubs to mow their links with motor cultivators. The cultivator shown in the illustration was built for regular farm work, but when they hitched the mower to the cultivator, and started across the course, it was seen at once that they had hit upon a method of mowing that far surpassed the horse mower, both in the saving of time and the quality of the job.

The cultivator requires only a few slight changes in the attachments to prepare it for raking the golf course and doing various odd jobs in parks or gardens.



This new champion of the golf links plays the course in half the usual time consumed by horse-drawn apparatus



The greater the trailer load, the greater the downward pressure applied to the tractor's rear wheels by this connection

New Tractor-Trailer Connection

A NEW type of connection between a motor tractor and a four-wheeled trailer is designed to vary the pressure on the rear tractor wheels so that, no matter what the load carried in the trailer, the tractor rear wheels will always have sufficient traction to start the load.

A varying proportion of the weight of the load is exerted on the tractor platform by attaching the front end of the rigid trailer drawbar to an eye on the rear deck or platform of the tractor. This eye may be raised or lowered by a worm-and-screw device operated from the driver's seat. Thus a greater or less pressure may be exerted.

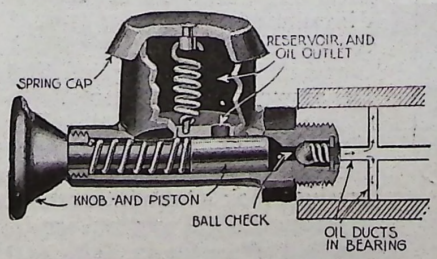
Getting Rid of Grease on the Automobile

SLOWLY but surely the automobile engineers are getting rid of grease-cups and replacing them with oil lubricators. Grease-cups have never been entirely satisfactory because the caps rattle off under vibration, as when the car is going over a rough road, and because grease does not lubricate when it hardens. Oil, on the other hand, lubricates more readily because of its greater fluidity. Until now, the problem has been how to build an oil-cup that would not rattle off or permit the oil to leak out while the car was standing still.

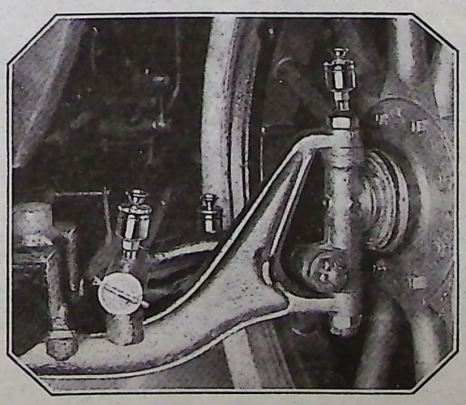
The latest type of oil-cup is made in two forms, one with a vertical barrel for such parts as the steering knuckle and drag-link, and the other with a horizontally placed barrel for such parts as the front and rear spring bolts and shackle bolts. The vertical barrel type is thus used at four places on a car, two alike on either side, and the horizontal type at twelve places, six alike on each side of the car.

Both types are designed on the same principle and include an oil reservoir emptying into a small cylinder. This cylinder is fitted with a piston which normally is kept at the bottom by means of a spring around the piston-rod, which extends out through the top of the oil reservoir in the case of the vertical type of cup and out of one end of the cylinder in the horizontal type. At the bottom of the cylinder in each case, on that end nearest the bearing to be lubricated, is a ball check valve like that shown below in cross-section.

A knob is provided on the end of the piston-rod, outside of the cylinder.



The cross-section shows clearly the extreme simplicity of the oil-cup



The cup will not rattle off or allow the oil to leak while car is standing

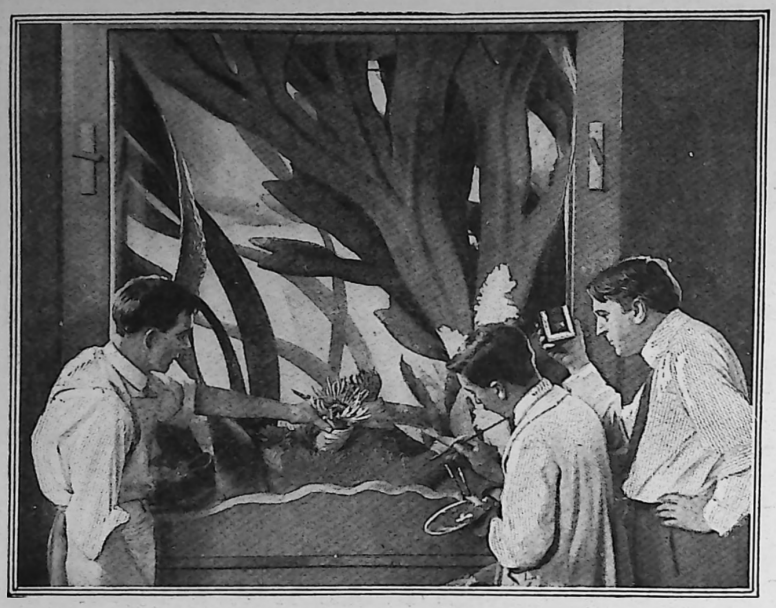
A pull on the knob of each oil-cup oils the car

When this knob is pulled, it moves the piston to the top of its cylinder, uncovering a hole leading from the oil reservoir and permitting the oil to fill the cylinder. Then, as the knob is released, the piston moves back by reason of the coil spring around the piston-rod, pushes the ball check valve off its seat, and forces the oil into the bearing.

With a car equipped with these oil-cups, it is necessary simply to walk around it and pull out each oil-cup knob once or twice and let it snap back in place. Each cup holds enough oil for from two weeks to a month, depending upon the use of the car.

By keeping the oil in a separate compartment, it is only fed to the bearing each time the knob is pulled out and snapped back.

Reproducing Nature in Wax and Glass and Plaster



The seaweed is made of wax, the shell-fish of wax with glass tentacles, and the section of scallop shell on which it rests, of plaster of Paris. The whole is a realistic picture of life at the bottom of the sea

WHEN the American Museum of Natural History, in New York, decides to make a wax model of what the movies would call a "close-up" of the bottom of the sea, Mr. Roy W. Miner, the Associate Curator of Invertebrates, assembles his staff of three experts and takes them to the place where the weeds and sea-creatures that he wishes to reproduce are to be seen in real life. Photographs are taken; Mr. Shimotori, the artist, makes drawings in color; and Mr. Chris E. Olsen makes a small clay model to scale right on the spot.

From his models Mr. Olsen makes plaster molds in which white beeswax is cast to make the required leaf or fish. When the modeling is finished Mr. Shimotori colors the various parts. He uses oil colors and applies them with ordinary artists' brushes and the air-brush. In the lower picture Mr. H. Mueller, with the working drawing in front of him, is making delicate glass spines for a wax sea-worm's head. His apparatus consists merely of a gas blowpipe and his skilful hands.

To make glass work as fine as lace, all you need is a blowpipe and a pair of skilful—very skilful—hands

The under-water background has to give the impression of fading away into the distance, and the light has to be carefully adjusted accordingly.

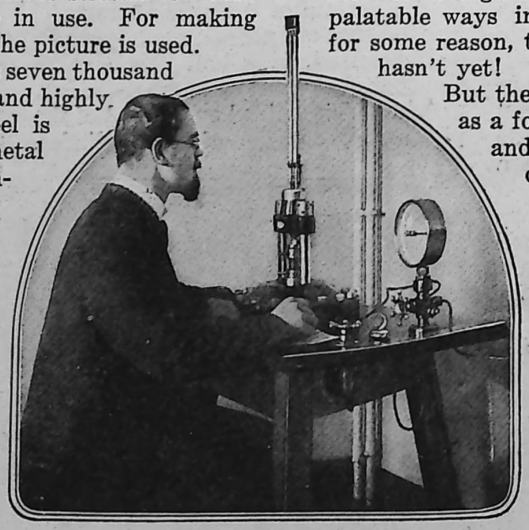
This effect is obtained by making the background of five separate sheets of glass, one in front of another. Upon the first are painted seaweed and fish, slightly blurred at the edges. On the other sheets of glass are painted objects of greater and greater indefiniteness. Finally, the ground-glass window behind the model is colored the greenish tint that water gives, and behind it a series of prisms is arranged to diffuse the light.

A New Way to Test Metals

IRON, steel, and other metals employed for technical purposes are now carefully tested for their surface hardness and their power of resisting various stresses to which they may become subjected while in use. For making these tests the apparatus shown in the picture is used.

By a hydraulic pressure as high as seven thousand pounds to the square inch a small and highly polished ball of extremely hard steel is pressed against the surface of the metal to be tested. The depth of the impression made in the surface of the metal is measured by delicate instruments and the relative hardness of the metal is determined by comparison with a predetermined scale.

The same apparatus and the same method, called the Brinell test after its inventor, is also employed for stress tests of metals. After the steel ball has been pressed in the surface a cross-section of the tested metal is made which is etched with acid and then examined with the microscope which discloses all structural changes produced in the metal by the pressure of the ball.



In testing the surface hardness of metals a hard steel ball is forced against the metal by hydraulic pressure. This man is watching the manometer indicating the pressure applied in the test

Soya Beans to the Rescue

THE praises of the Chinese soya bean as food have been sung by experts who wanted to bring down the cost of living. Industriously they gave exhibits of palatable ways in which it could be prepared. Still, for some reason, the soya bean as food didn't take—or hasn't yet!

But the soya is a versatile bean. Cast off as a food, it proves itself valuable as a paint and varnish oil! Its possibilities in this direction were first investigated some time ago, when the failure of the flax crop in the Northwest caused a serious shortage of linseed oil. A large quantity of soya beans was imported from Manchuria and distributed pretty generally through the country with the cooperation of the United States Department of Agriculture.

The beans grew well in all sections, but throve most lustily in the South. Here the cottonseed crushers took a keen interest in the experiment. Oil was crushed from the beans grown in this section and experiment established its desirability as a paint oil.

The Diamond and Its Bloody Story

All the revel, riot, recklessness, quick dramas, and dazzling riches of all the world's mining rushes and gold stampedes are crowded into the mad romance of the diamond

By Walter Noble Burns

ALL the diamonds in the world could be packed in your wife's clothes closet. They could be stored in a kitchen pantry, where, in the dim light, the cook might mistake them for navy beans and attempt a puree. They would form a pile about as big as the pile of coal the truckman dumps on the sidewalk at the basement entrance to your apartment building. If the pile had a base diameter of eight feet and were rounded into a cone, it would be five feet high. A pile of coal of equal size—and coal by every tie of chemical relationship is the diamond's first cousin—would cost $28. The pile of diamonds, reckoned at $100 a carat, would have a value of $4,635,547,480. If figured at current diamond prices, it would be worth from three to five times that much.

There are, it is estimated, 46,355,474 carats of cut and polished diamonds in existence. In terms of avoirdupois they would weigh 10½ tons. The total includes possibly the first diamond ever found on earth—who knows?—and the last gem picked from the chimneys of South Africa; the little twinkler that the shop girl wears on her finger and the Kuh-i-Nur that blazes in Great Britain's crown.

The War Advanced Diamond Prices

One hundred dollars a carat, used as a basis in the estimate, is perhaps below the average cost of diamonds throughout history. Diamond prices have been subject to wide variations. The war advanced the price about one third. Present prices are about one hundred per cent. higher than those of fifty years ago, and they undoubtedly will go higher in the next few years. But every diamond is an individual problem as far as price is concerned. The price always depends on the stone's color, comparative flawlessness, inherent brilliancy, and cutting.

A one-eighth carat diamond sells at present for from $12.50 to $20; one-fourth carat from $37.50 to $62.50; one-half carat from $100 to $200; three-fourths carat from $187.50 to $337.50; one carat from $300 to $500. Importers buy rough diamonds in foreign markets for about $90 a carat. A rough crystal of 2½ carats, which will cut to a gem of one carat, costs $225. Import duty is 10 per cent.; 1 per cent. is to be added for insurance and brokerage charges; the labor of cutting may be figured at $15. The polished one-carat gem thus represents an outlay of about $250. If this diamond turns out to be a gem of first quality, it will retail at from $500 to $550.

But such quotations are not wholly dependable. Some blue-white one-carat stones sell for $2,500, while you can buy a one-carat yellow diamond for $150. Blue-white diamonds bring the highest price in the market. But many connoisseurs prefer as more beautiful the snow-white gem often found among river diamonds, whose sharp, cold brilliancy is like that of clear ice gleaming in winter sunshine.

The diamond was a clumsy jewel of dull luster until the art of cutting and polishing it was discovered in the fifteenth century. If the stone is large the first step is to make an incision and then to cleave it with a mallet, which two steps are illustrated by this picture

Democratic Uncle Sam and His Diamonds

The United States in recent years has become the greatest diamond-buying nation on the globe. For years it absorbed from fifty to sixty per cent., and during the war 85 per cent. of the output of the South African mines, which supply 98 per cent. of all the diamonds in the world's markets. A recent estimate placed the value of the diamonds in this country today at $1,350,000,000. Of this $500,000,000 was set as the value of the stones in the country in 1900. Importations since 1900 have amounted to $506,000,000, this including

Some of the Diamonds that Have Had a Thrilling Past

A *B* *C* *D* *E*

The Regent, or Pitt (*A*), weighed 410 carats, and was bought for about $120,000 by Pitt, Governor of Madras. The Duke of Orleans, Regent of France, paid $400,000 for it. It was cut to nearly 137 carats, and was stolen during the Revolution, but was recovered and is still in France. The Kuh-i-Nur (*B*) led one Indian potentate to kill his three brothers and imprison his father. It has been cut and recut. It weighs now 125 carats and has been valued rather fancifully at $1,000,000. The Pigott (*C*) weighed 82 carats. It was last heard of in Egypt. It is valued at $150,000, rather little for a stone of such size. The Empress Eugénie (*D*) weighs 51 carats, and is the property of the famous Gaikwar of Baroda. Two centuries before it shone on the bosom of the proud Eugénie it was given by a peasant to a blacksmith for mending a plow. The Duke of Westminster owns the Kassak (*E*), weighing something under 79 carats. Little is known about it

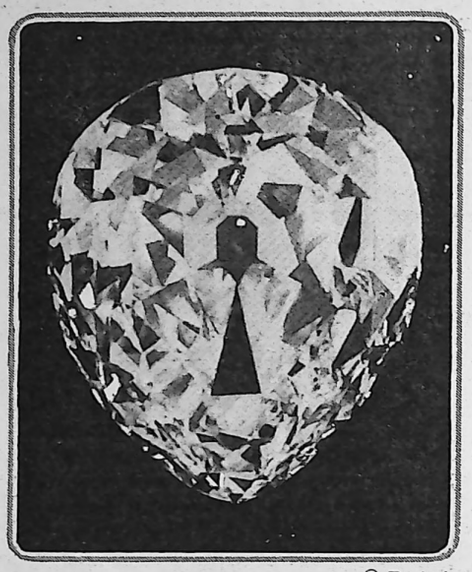
$175,000,000 worth of rough stones which were doubled in value by cutting.

Prosperity has no better barometer than the diamond trade, and the increase in diamond buying year by year has reflected the nation's growing wealth. Yearly importations of cut diamonds increased from $1,317,420 in 1867 to $27,000,000 in 1913. They fell to $18,000,000 the first year of the war, and to $9,000,000 in 1915. They showed a reaction from war conditions in 1916, when they reached $20,567,222, and were $21,855,735 in 1917 and $13,925,772 in the first eight months of 1918. The diamond-cutting industry in the United States began in 1873, when $176,426 worth of rough stones were imported. Importations amounted to more than half the importations of cut stones in 1916 and 1917, and had become almost equal in 1918.

Time was when they adorned only the princes of the earth and sparkled only in palaces. But they have become a democratic gem in the great democracy of the West. The stenographer emits Kimberley sparkles. Faint Dutoitspan gleams show in the ears of the pretty waitress. No cook or housemaid can hold up her head without a diamond among her jewels.

Diamond Cutting—a Distinctly Modern Art

The perfectly cut and brilliant diamond the world knows today is not more than fifty years old. The ancient world knew little of diamonds. From the first pharaoh to the last, through all the pageantry of thirty-one dynasties, diamonds were unknown in Egypt. From the dawn of history, Babylon remained unfamiliar with them for forty centuries. The pioneering conquest of Alexander across the Indus in 327 B.C. acquainted Greece vaguely with their existence. The patricians of Rome in the days of the early empire rarely owned them. Byzantine supremacy, the rise of Venice to maritime power, the Moorish conquest of Spain, brought only a trickle of diamonds into western Europe. A fashionable jewelry store in America today carries more diamonds in stock than were in all Europe when Columbus sailed from Palos.



© Topical

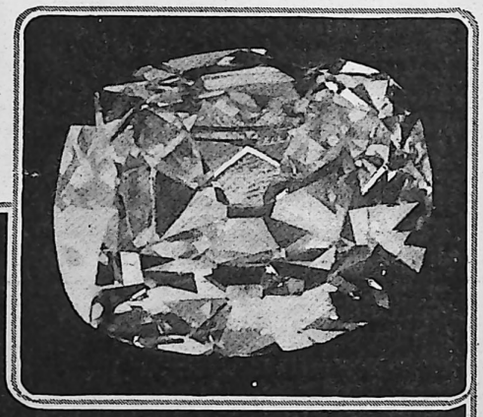
The Cullinan diamond was divided into nine large stones and a number of small brilliants. Here is the biggest of the stones. It weighs 516½ carats and is the largest brilliant in the world

The earliest cutters used their wheels deftly enough, but they neglected their mathematics. Bringing out a diamond's full brilliancy is a mathematical problem. Increase of facets adds to surface area and surface glitter. But the angle of total reflection must be considered in relation to the angle of incidence, and the facets so arranged that a ray of entering light will be reflected from the inner facet surfaces and returned in refracted rainbow sparkles through the top of the stone.

Making the Diamond Sparkle—a Mathematical Problem

Henry D. Morse, of Boston, in the last century was the first to discover the balanced proportions that developed a diamond's highest reflective and refractive possibilities. Since brilliancy is the crowning glory of a diamond, he did not hesitate to sacrifice whatever weight was necessary to achieve it. Retaining the fifty-eight facets of the earlier cutters, he found that a diamond is at its sharpest climax of brilliancy when its depth from table to culet is six tenths of its diameter, and a little more than two thirds below. Cut in this style, a diamond not only flashes light from every polished facet surface, but seems alive with coruscating inner fires.

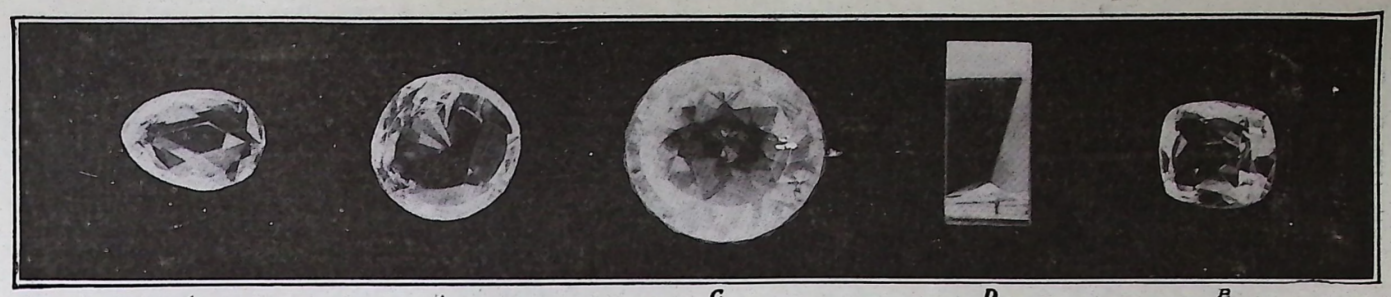
Morse's proportions are the rule of the world today, and they mark the final



To the right is a brilliant weighing more than 309 carats. It is the second largest stone cut from the famous Cullinan

To the left is the Cullinan diamond as it appeared in the rough. It weighed in this state 3,025¾ carats (1⅓ pounds) and was as white as water. The stone was purchased from the Transvaal Government in 1907 and presented to King Edward VII

To the right is the Excelsior diamond, found in 1893 at the Jagersfontein by a native while loading a truck. It weighed 971 carats in this rough state, and was ultimately cut into ten stones weighing from 68 to 13 carats



A B C D E

Swallowed by a faithful serving-man to save it from the robber who slew him, the Sancy (*A*) was sliced from his stomach to adorn the royal person of Henry of France and Navarre. The Orloff (*B*) was stolen by a French soldier from the eye of an idol in a Brahmin temple, stolen again from him by a ship's captain, bought by Prince Orloff for $450,000, and given to the Empress Catherine II. It weighs nearly 105 carats, and was one of the Russian crown jewels. The great Mogul (*C*), most magnificent of Indian gems, disappeared from history, never definitely to reappear. It has a bloody history going back to the year 1665. Its fame lured Nadir Shah to the sack of Delhi. This is a glass reproduction made from extant descriptions. It probably weighed after cutting, 280 carats. The Akbar Shah (*D*) was originally a stone of 116 carats with Arabic inscriptions upon it. After being cut down to 71 carats it was bought by the Gaikwar of Baroda for $150,000. The Polar Star (*E*), a magnificent stone weighing 40 carats, belongs to the Princess Youssoupoff

triumph of art in the achievement of the perfect modern jewel.

Fiction in its maddest moods never invented romance more bewildering than the stories of the great diamonds of India. For these baubles wars have been waged, nations devastated, thrones and dynasties overturned, men slaughtered by tens of thousands. For gems men have plotted, intrigued, robbed, murdered, committed every cruelty and treachery, stained their souls with every crime.

The fame of the Great Mogul lured Nadir Shah to the sack of Delhi. Desire to possess the Kuh-i-Nur was woven into the complex motives that led Aurung-zeb to deluge India with blood, slay his three brothers, and dethrone and imprison Shah Jehan, his father.

The Orloff, stolen from the eye of a temple idol and sold overseas, was presented to Catherine of Russia by her princely paramour to patch a lovers' quarrel. Swallowed by a faithful serving man to save it from robbers who slew him, the Sancy was sliced from his stomach to adorn the royal person of Henry of France and Navarre.

The Great Mogul, the most magnificent gem of the Indian mines, disappeared from history, never definitely to reappear, its fate a riddle of the centuries.

© Harris & Ewing

The ill-starred Hope diamond eventually passed into the possession of Mrs. Edward Beale McLean, whose husband bought it for $300,000. She wore it on one occasion together with the Star of Este, the two stones together being worth $500,000. The occasion was a dinner which, a curious statistician figured, cost about $166 a minute

The Baleful Gleam of the Hope Diamond

The Hope blue diamond—stone of tragic fame—is the only one of the great historic diamonds to come to the United States. When Louis XIV bought it in the seventeenth century, it was a gem of 67½ carats. It disappeared during the French Revolution, and remained lost until 1830, when it reappeared as a jewel of 44¼ carats.

From its first appearance in Europe, a superstition has clung to it that it brought disaster to all whoever owned or wore it. Certainly it has been associated with a long list of tragedies. Tavernier, who brought it from India, failed in business, and died on his voyage back to the Orient to recoup his fortune. Madame de Montespan, upon whom the Grand Monarque bestowed it, was supplanted in the king's affections by her rival, Madame de Maintenon. Nicholas Foquet, a courtier who borrowed it, was executed. Louis XVI and Marie Antoinette, who inherited it, lost their heads on the guillotine. Princess de Lamballe, of Marie Antoinette's entourage, was killed by a revolutionary mob.

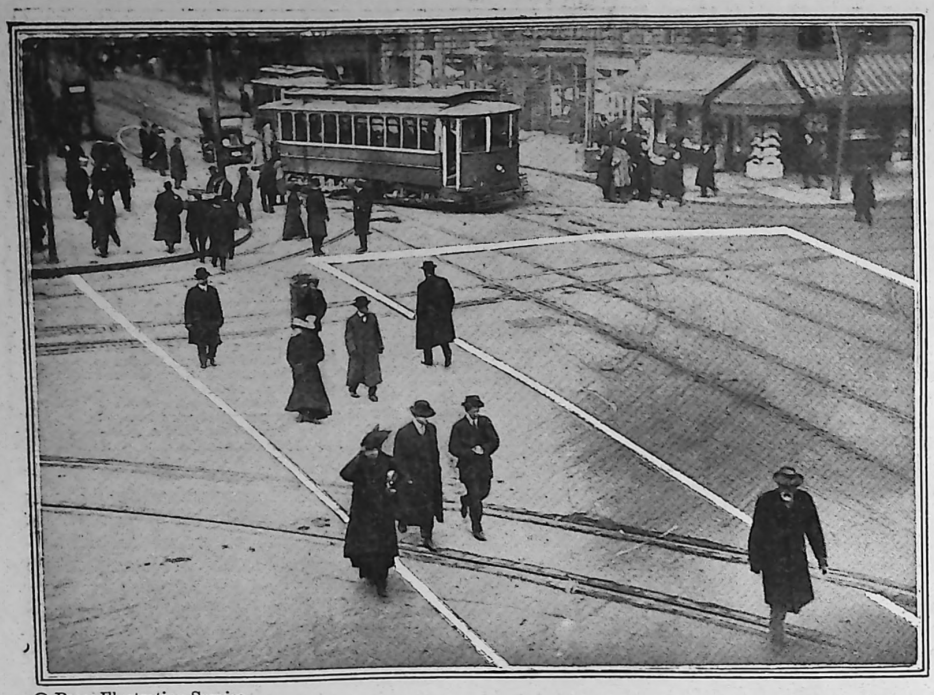
The thieves who stole it were executed or deported to penal colonies. Wilhelm Fals, the gemsmith who cut it down for them, ended his life in poverty. Hendrik Fals, his son, who stole it from the thieves, committed suicide. Francis Beaulieu, last of its underworld owners, who sold it to Daniel Eliason, a London jeweler, died of starvation in a garret in Soho. Lord Francis Hope became a bankrupt, and was scandalized by the elopement of May Yohe, his American actress wife. At last accounts May Yohe was a scrubwoman in Tacoma.

Lorens Ladue was shot and killed by her infatuated admirer as she danced in the glare of the footlights with the diamond on her bosom. Her Russian cavalier, who had hung the jewel about her neck, was assassinated. Simon Montharides, who sold it to Sultan Abdul Hamid, was killed in an accident. Two of its Turkish custodians were murdered. Salma Subaya, the sultan's favorite, was shot while in the Yildiz Kiosk; and Abdul Hamid finally lost his throne.

Imported into the United States, it was bought by Edward B. McLean for $300,000. As beautiful as when, fresh from the mystic East, it dazzled the court of France, the diamond for years brought only happiness to its new owners. Then one day the little son of the McLeans, first-born of a happy marriage and heir to vast riches, was killed at play by an automobile. Instantly the tragic tradition recurred to the public.

A B C D E

The Florentine diamond (*A*), among the crown jewels of Austria, weighs 139½ carats and is valued at $525,000. It is a very pale yellow. It was picked up on a medieval battlefield and sold for two francs. The Hope (*B*), 44¼ carats, is believed to be a portion of a beautiful blue stone of 67 carats cut from a stone weighing over 112 carats, which was discovered in India, brought to Europe by Tavernier, and which was stolen from the French crown jewels. The Hope has the same color as the missing gem. The Kuh-i-Nur (*C*) eventually passed into the hands of the East India Company, and was presented by it to Queen Victoria in 1850. This is a picture of it recut to 106 carats. The Star of the South (*D*), perhaps the most famous of Brazilian stones, was found in 1853. It was cut from 254½ carats to 125 carats, and was bought by the Gaikwar of Baroda for $400,000. The Pasha of Egypt (*E*) weighs forty carats and is valued at $140,000



© Press Illustrating Service

Between these lines lies safety. This is Cincinnati's idea of first aid to preoccupied pedestrians. It's a woman who is ignoring the rule and cutting across the corner

How They Cross the Street in Cincinnati

LINES and feet seem to be indivisibly connected. We have been enjoined, ever since we can remember, to "toe the line." More recently, New Yorkers have been ordered to "follow the black line" and "follow the green line" when adventuring in the subway.

Cincinnati works along still other lines. The city fathers have had lanes marked out by two white lines at the busy crossings, with the legend on the curb-stone, "Walk between the lines." Vehicles do not cross the safety-zone until they are signaled to do so by the traffic policeman.

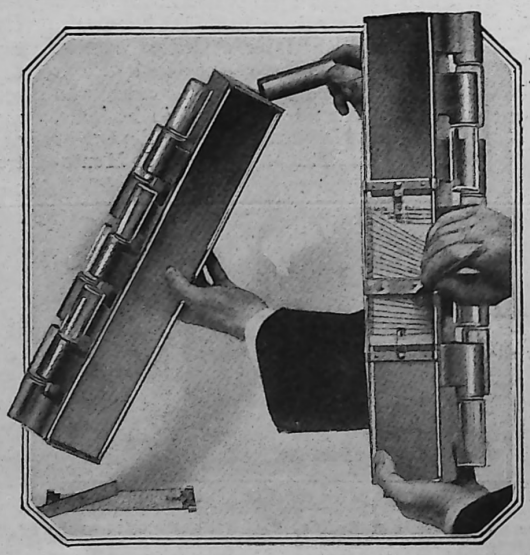
At present the white marks are painted on the pavement, but they are to be made permanent with white bricks.

This Apparatus Tests Sand on the Job

A SIMPLE apparatus recently invented makes it possible to test the sand to be used in concrete work without sending samples to the testing laboratory. It consists of a rectangular metal box with an opening at one end. By five screens graded as to mesh and soldered to the sides of the box the receptacle is divided into compartments, each communicating by soldered elbows with small glass vials placed in two rows on the outside of the box.

In making the test a measured sample of the sand is poured into the box and shaken through the screens. Then water is added, the opening closed, and by a gentle swaying motion the sand on the five screens is washed into the corresponding vials.

The sand is allowed to settle before the record is taken. The record sheet is fastened to a sliding pad, and on it cross lines are drawn indicating the levels of the sand in the five vials. These lines intersect the index line at certain points and the slanting lines of the percentage scales indicate how large a percentage of the sand passed or was retained by each screen.



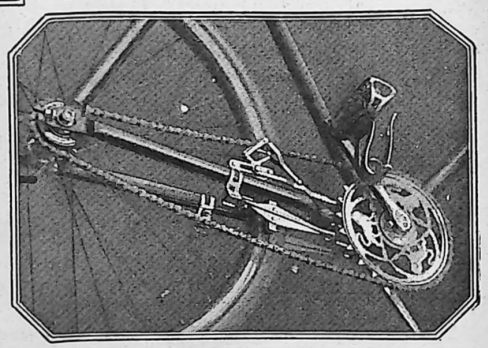
Sand is poured into the testing apparatus, shaken into glass tubes through graded screens, and the result recorded on a specially ruled sheet

The Bicycle Gets Its Emergency Brake

SNAP! The brake-band broke and the cyclist shot down the hill at a speed that increased with every second. If his wheel had been equipped with an emergency brake there would have been no danger.

Such a brake was recently invented by a Frenchman. To work it you simply back-pedal. Forward-pedaling keeps the chain tight, while back-pedaling slackens it. The emergency brake has a tooth, which is stationed just below the tight chain. When the chain slackens, one of its links drops over a tooth and pulls it backward as the rider continues to back-pedal. This movement of the tooth affects levers that press on the sides of the rear wheel and act as a brake.

In the picture below you can plainly see the tooth and chain interlocked, while a small bar presses down on the rim of the wheel.



This bicycle has an emergency brake which is worked simply by back-pedaling

When It's Clean-Up Day in Poland

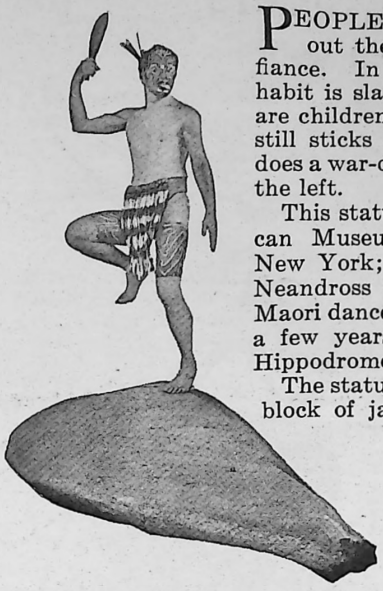
"ALL men, boys, and young girls must have their heads shaved completely on April first." Suppose our government issued this order, how would you like it? Poland has issued this order.

Ever since war broke out in 1914, Poland has suffered severely from typhus. The hair-cutting order is simply part of an extensive campaign for wiping out the disease. On the same day that their hair is cut, the victims must also take a bath.

The campaign will last for three months and each village is assigned a clean-up day. The people are also supposed to disinfect all bedding and clothing on that day. Health authorities point out that if typhus is not stemmed in Poland it will soon spread to all western Europe.

Poland will need for her general clean-up one hundred physicians, one thousand steam disinfecting machines, eight hundred thousand pounds of cresol, and three hundred tons of soap.

A War-Dance on a Block of Jade



The largest block of green jade known to exist has mounted on it the statue of a Maori warrior

PEOPLE the world over stick out their tongues to denote defiance. In civilized countries this habit is slapped out of us when we are children, but the Maori warrior still sticks his tongue out when he does a war-dance—note the statue at the left.

This statue is found in the American Museum of Natural History, New York; it was made by Sigurd Neandross and was posed for by a Maori dancer brought to this country a few years ago to dance in the Hippodrome.

The statue is poised on the largest block of jade known to exist. It weighs three tons, and is seven feet long and four feet wide. Both the dancer and the jade came from New Zealand.

This decoration in front of the window is a willow root that grew within a water-pipe and gradually cut off the water supply

Watch Out for Willow Roots

HANGING up in front of the Water Department of the village offices at Lakeville, N. Y., there is a twenty-four foot willow root. And the Water Department keeps a careful eye on it, for it is a trouble-maker—last year it very nearly cut off the city's water supply.

Here's how it happened. Twenty years ago a wooden plug was driven into the pipe and a small tendril from the root of a willow tree near by got mixed up with it. This tiny root grew rapidly within the pipe and gradually choked off the flow of water.

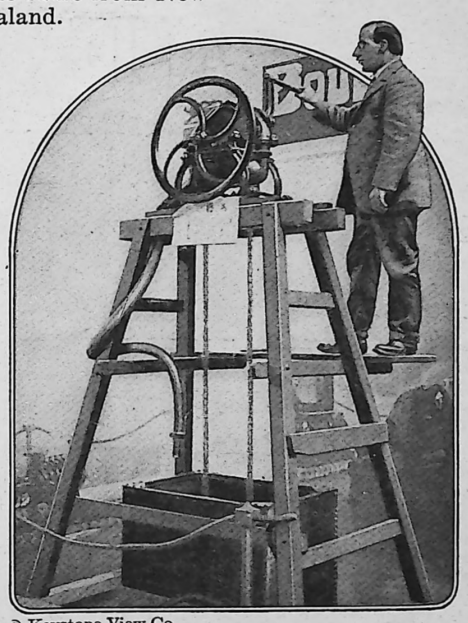
The Water Department naturally thought there must be a leak somewhere. Three men were sent out to find it: instead they found twenty-four feet of willow root clogging the pipe.

To remove it a section was cut from the pipe and a strong rope fastened around the head of the root. It took three men to pull it out. The root is now supported by three hooks on the window of the village offices, and the admiring natives visit it regularly.

This Pump Is Called a "Mechanical Impertinence"

WHEN an eminent British scientist saw this pump at the Dairy Show in London, he was so astonished by its simplicity that he laughingly called it a "mechanical impertinence."

The water is drawn up by an endless chain enclosed in close spiral coils. The chain is weighted at the immersed end by a grooved wheel. At the upper end the chain rests in the groove of another wheel, which may be rotated by hand or by motor. As the chain is drawn through the water the liquid fills the space between the links and the coils of the spiral and is held there by capillary attraction until it is released by centrifugal force as it is whirled around the driving wheel at the top. The length can be adjusted.



© Keystone View Co.

It pulls up water by an endless chain surrounded by a spiral coil which holds the liquid by capillary attraction

Oscar Duffy, aided by his two sons, is making molasses in a homemade mill out of sorghum grown in his own back yard

Grow Your Own Molasses

WHEN food was scarce here because of Europe's need, people grew food in their back yards. Now that sugar is scarce, why not grow sugar-cane there? Mr. Oscar C. Duffy, of Springfield, Ohio, tried it, and now he has twelve gallons of sorghum molasses in his cellar.

It was not the sugar-cane of the sunny South that Mr. Duffy grew, but Chinese sugar-cane or sorghum, which is hardier than sugar-cane and comes to maturity in one season. It is a cereal and the sugar is in the stem.

When the sorghum was full grown, Mr. Duffy found that there was no mill near by to which he could take it. What did he do? He built his own mill, which he operated with the help of his sons. He made the mill out of two wash-tubs, a clothes-wringer, two four-inch rollers, and several planks.

He crushed the stalks between the rollers and the juice and pulp fell into one tub. Next he ran the pulp through the clothes-wringer and extracted more juice. He boiled the juice in a wash-boiler and molasses was the result.

These Are the Real Money-Makers

They are turning out pennies galore so that we'll all have enough to pay our war taxes

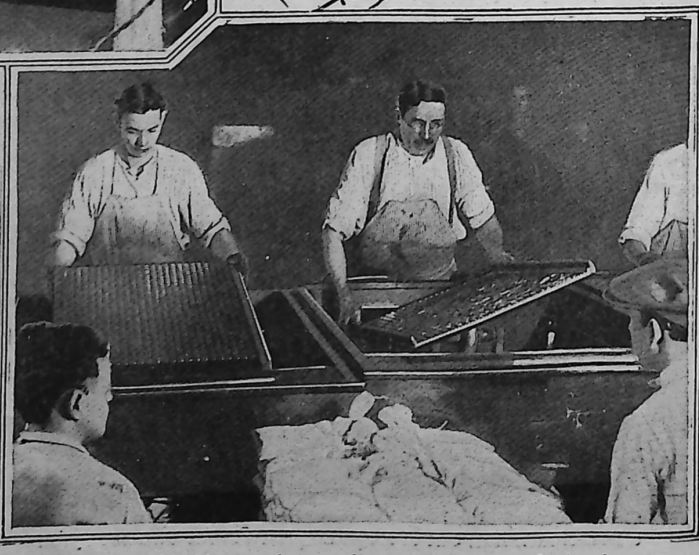
Photographs © International Film Service

Sixty million pennies are turned out in one month and a great many of them pass through this tray on their way to the stamping-machine; the white-haired lady inspects the disks and picks out those that are imperfect

Pouring the disks in the stamping-machine, where they are molded into final shape

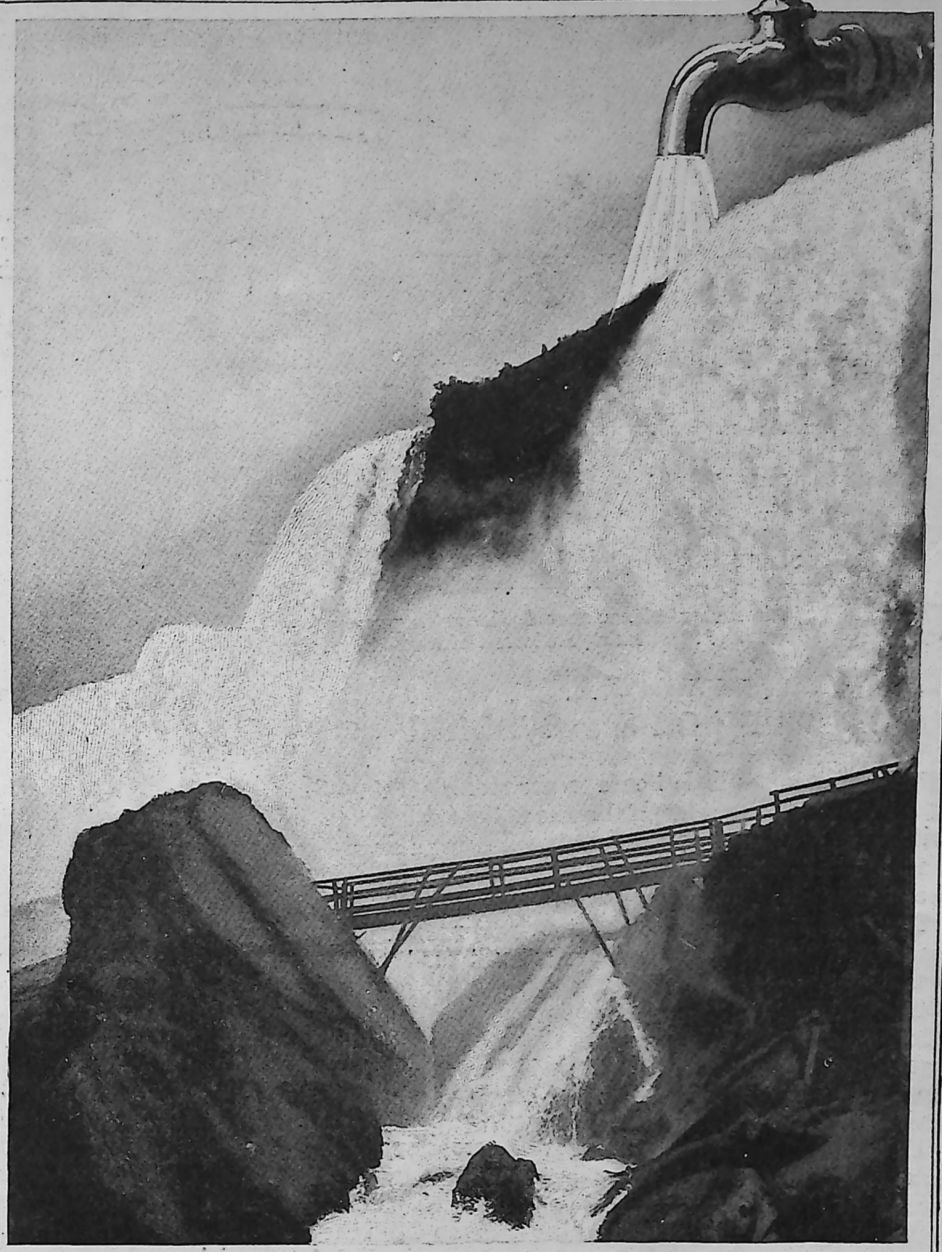
The long strip of copper being fed to a punching-machine in which disks are punched out at the rate of one hundred and fifty a minute

The finished coins scooped into scales and weighed in large quantities to determine the gross number turned out, the number of pennies to the pound being known. There are about seven hundred dollars' worth of pennies in the scale now



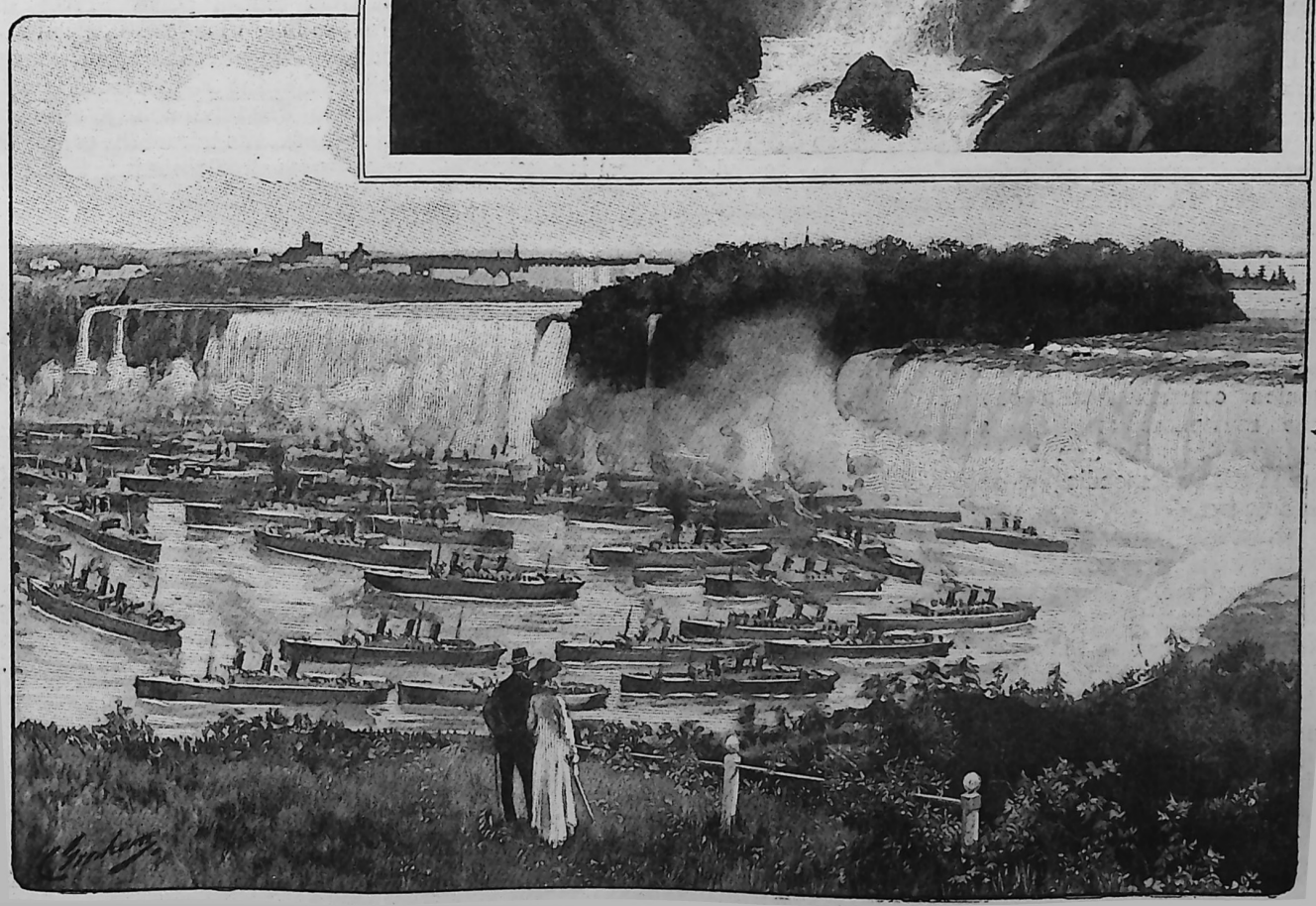
Each board holds one thousand pennies, a penny fitting into each slot; when all the slots are filled the pennies are dumped into a bag, ready for distribution. The Mint at Philadelphia runs night and day to supply the demand

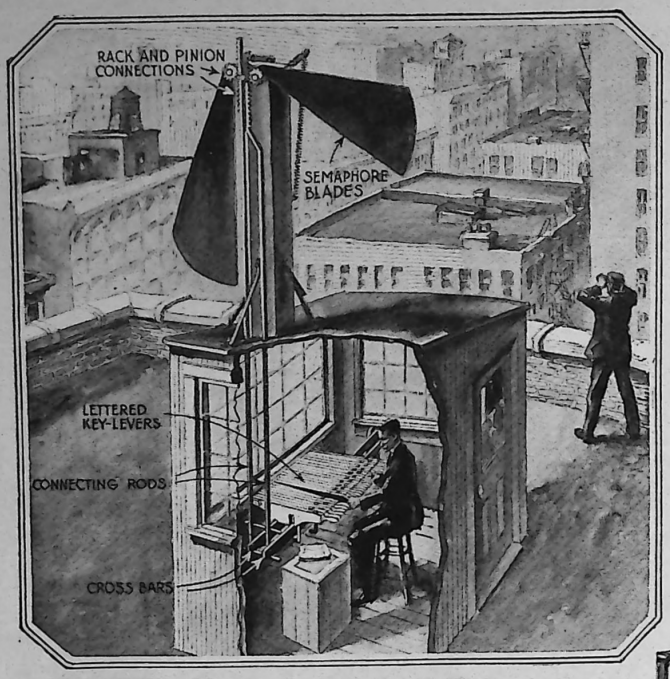
Prohibitionists and "Antis" Take Notice



How much water is used for personal purposes by the American people? We mean for drinking, bathing, cooking, and washing. Statisticians say that the average family contains three members, and that each family uses an average of 90 gallons a day. Hence each member of a household uses 30 gallons a day. Now, the present population of continental United States is approximately 105,000,000. The total consumption of water for household and personal use amounts to the enormous total of 400,000,000 cubic feet daily. What has all this to do with Niagara Falls shown at the right with an enormous water faucet turned on full? Just this: the daily consumption of water in the United States is enough to keep a Niagara Falls going for the period of thirty-five minutes

A ship afloat displaces an amount of water equal to its own weight. Thus the *Leviathan*, with a tonnage of 50,000, displaces 1,600,000 cubic feet of water. It would take 250 such giant steamers to displace the quantity of water that the American public is said to consume every day





The operator of this mechanical semaphore spells out his messages by pressing down levers representing the letters of the alphabet

Signaling on a Keyboard

THE man in the little house on the roof is not ringing chimes, nor is he playing the calliope or setting switches in the railway yards; he is operating a semaphore of an improved pattern, spelling out the letters of a message to a distant observer.

The man who signals with flags or who uses one of the numerous mechanical signaling apparatuses heretofore tried, must go through a course of training before he can safely be entrusted with sending or receiving messages. With the apparatus shown in the picture anyone who is capable of reading can send messages.

Each lever represents one of the letters of the alphabet. The levers are arranged like the keys of a piano or a calliope, all being pivoted to the same stationary rod or bar fastened to the wall of the cabin. Each of the two blades of the semaphore is connected by a rod with one of the two parallel cross-bars shown in the picture. These cross-bars are pivoted at one end, while the other end has a rack-and-pinion connection with one of the semaphore arms in such manner that the arm is raised when the corresponding cross-bar is depressed.

On their lower edge the key levers have notches which engage the cross-bars. These notches are so gaged that, when the key lever is pressed down to the stop, the cross-bars will be depressed so as to bring the semaphore blades to the position representing the letter of that particular key. When the key lever is released, the semaphore arms are snapped back to their original position by powerful springs.

In Behalf of Window-Washers

NO one likes to wash windows. If you sit or stand outside you run the risk of falling. If you work from the inside you must go through contortions in order to reach the center point on the outside of the lower window-pane. Is there no remedy for this?

Yes, says Alexander Kuneman, of Erie, Pa.; for he has invented "new and useful improvements in windows" distinctly for the purpose of facilitating window-washing. The lower sash is mounted so that it will swing, and the upper one may be lowered and fastened to it so that the two will swing together. When you wish to wash windows you swing the two sashes into the room and do your washing in comfort. When the upper sash has been polished, slide it back into place. The lower sash may then be swung in alone, and given its turn at the chamois.

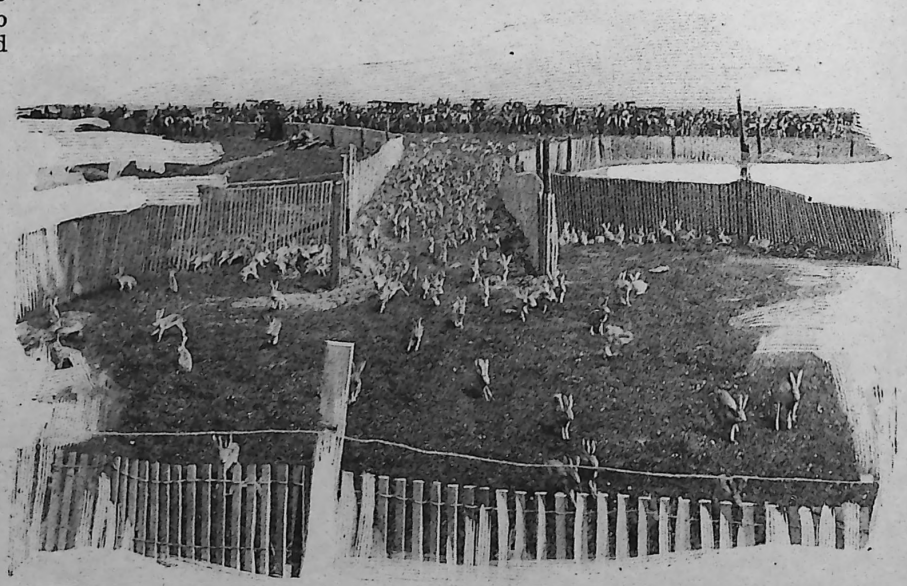
It is a well-known fact that unionized window-washers make more money than most college professors. But window-washing is a dangerous job, particularly when the window in question is on the fortieth floor of a building.

When you wish to wash this window you simply swing it into the room

War on the Jack-Rabbits

JACK-RABBITS multiply so rapidly that their depredations on growing crops frequently become a real menace. In many parts of the Middle West active measures have to be taken to keep down the numbers.

A wire-and-slat corral is constructed at some central point. From the entrance long wing-fences extend in a wide V. Every available man, woman, and child in the neighborhood is mustered to surround a large area and drive the rabbits toward the corral; the wing-fences steer them into the trap.



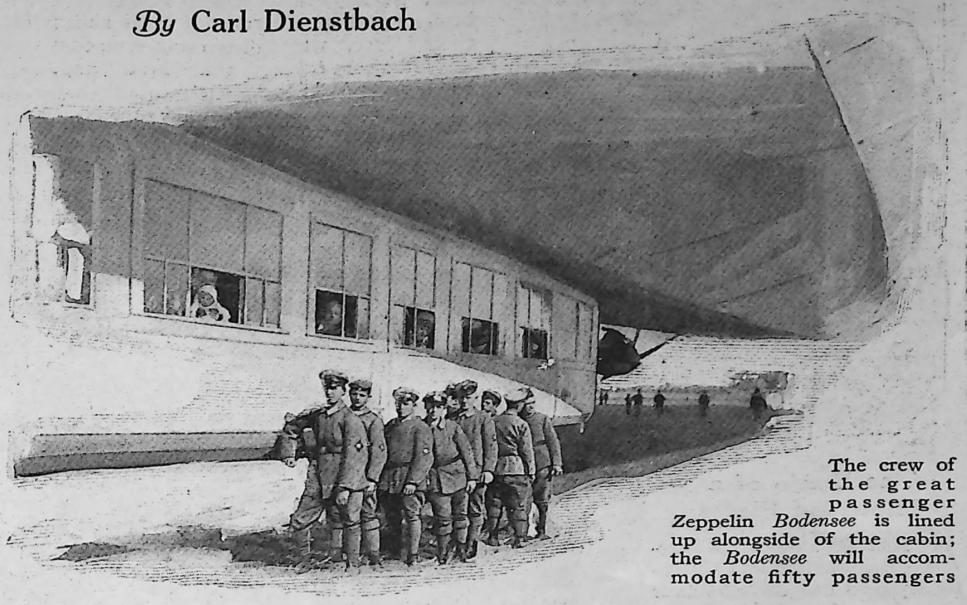
At the end of a perfect rabbit drive. These organized drives not only free the district of crop-destroyers, but provide a considerable source of food supply

She Carries Passengers Instead of Bombs

The new giant Zeppelin "Bodensee" can never be used in war

By Carl Dienstbach

WHEN recently the Hamburg-American Steamship line resumed its aerial passenger service, having built a new dirigible for the purpose, the agreeable fact became evident that this up-to-date Zeppelin was inherently a peace craft and could never be converted into a war craft. This new vessel, named the *Bodensee*, cannot navigate the air unless it carries its quota of passengers or an equivalent in ballast, which may neither be dropped nor consumed. This is due to a boldly novel distribution of weights.



The crew of the great passenger Zeppelin *Bodensee* is lined up alongside of the cabin; the *Bodensee* will accommodate fifty passengers

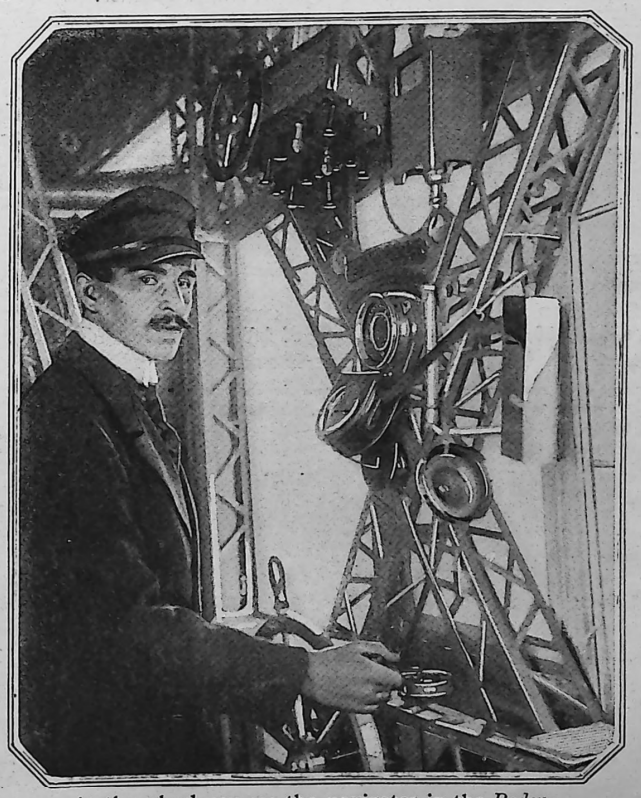
In former ships the passenger cabin was located, like the observer's seat in an airplane, at the center of gravity, where, full or empty, it could never disturb the balance. On the new ship the cabin is at the front end, ideally located for comfort and aerodynamical considerations, but out of balance when the Zeppelin is empty.

Suppose bombs or additional fuel for sea cruises were loaded into that cabin. The bombs could not be dropped because in that case the elevators would be so taxed in forcing the nose down against its sudden lightening that they would become unfit for other use. Letting out gas in front only would be too slow a compensation. This trouble is radical and inherent, because it could be remedied only by an entire redistribution of the fixed weights behind, which in turn would demand reconstructing the hull.

But let us discuss the peace possibilities of this design. To combine the navigating cabin in front with the passenger cabin is ideal. It insures in the whole front part the cleanliness, splendid repose, unlimited view, purity of air, and absence of fire danger of a spherical "free balloon." Navigating instruments and wireless are doubled in efficiency, the officers' nerves are saved by the remoteness of the engines and the proximity of comfort and a "mess" and pantry. Air resistance is splendidly reduced by the well proportioned long, smooth structure of this united cabin—the absence of fire danger making it possible to place the cabin tightly against the hull, giving direct access to its "hold."

Attention should be called to the glazing over of all the many windows necessitated by modern speed—in place of the "gaping holes" in the old cabins. The three engine-rooms are far behind, transmitting not a particle of vibration or noise, yet under instant control by telegraph and telephone.

The final and most telling plea of this craft for peace is in its size, preventing war altitudes. It is not at all a "super-Zeppelin," not even an old-fashioned naval Zeppelin. It accommodates fifty passengers and will reach Berlin from Lake Constance (that is, crossing three fourths of the German territory) within four and a half hours. The train takes fourteen hours. Passenger Zeppelins now call for a revision of established ideas on travel. All Europe is as easily within their direct range as the nearest fifty miles are to the owner of a Ford.



At the wheel you see the navigator in the *Bodensee*, a Zeppelin that makes regular passenger trips and belongs to the Hamburg-American Line

The completeness of commercial success of the resurrected peace Zeppelins may best be gathered from a statement made by an American lawyer who recently returned from a business trip through central Europe. He said that he would have "taken the Zeppelin" from Munich to Berlin if the day in question had not been the day of the Berlin-Friedrichshafen trip. It costs but one hundred marks to ride on the *Bodensee*.

You may remember the recent account of the accident which befell the *Bodensee*. She was landing in a high wind when suddenly she broke away and disappeared in the night. Her front gondola was smashed and one of her engineers was killed. She landed safely the next day several miles away. The men who helped her try to land were really responsible for the accident; they were friends of the passengers and knew nothing of the skill necessary in order to land a Zeppelin safely. It is just as hard to dock an airship safely as it is to dock a ship.

Women Jockies Come Next

SO far as we know there are no women jockies yet, but there may be a thriving crop of them before long. In England, at any rate, where women are busily upsetting all sorts of ideas about their "place," women have been replacing stable-boys in exercising race-horses, and, as everyone knows, every stable-boy who has a leg up at exercise time hopes to graduate soon into a full-fledged jockey.

The daughters of Sir Robert Wilmot, owner of a large racing stable in England, have shown the way, and the trainer says that they have unusually light and firm hands and that the horses appreciate the change from stable lad to stable lassie.

© Press Illustrating Service

© International Film Service

The Banjo of a Thousand Pieces

A BANJO made up of fourteen hundred and thirty-four pieces has traveled over sixty-four thousand miles in the last fifty years—and has never lost a piece.

The banjo with this record is studded with bits of pearl, ivory, and colored wood, in all shapes and sizes, and was made by its owner, Joe Patterson, of Eastport, Maine.

Joe Patterson is a wandering minstrel and one of the veterans of the old-time minstrel days following the Civil War. Although he is now sixty-six years old, he is still an active black-face comedian.

A Room Designed to Attract Aviators

WHIR! The aviator drinking tea in the Hotel Imperial looks up with a start. Surely it is an airplane's motor that he hears! And then he sees it projecting out of the ceiling, while its propeller whirls the air about.

No, the airplane did not crash through the roof. It was placed there purposely by the owners of the hotel. They had decorated the entire room with airplane parts in order to induce aviators to patronize the hotel. The engine hood, with its radiator and propeller, act as a fan as well, and cool off the air in warm weather.

When the engine needs cleaning the mechanic must stand on a ladder to get at it.

Inviting Guests with Bricks

YOU have heard of bricks being used to speed the parting guest on various occasions—usually when there has been a difference of opinion during the visit. To invite guests with bricks, when one is doing so in all good faith, is a new idea. However, it was done, and the party turned out to be a great success.

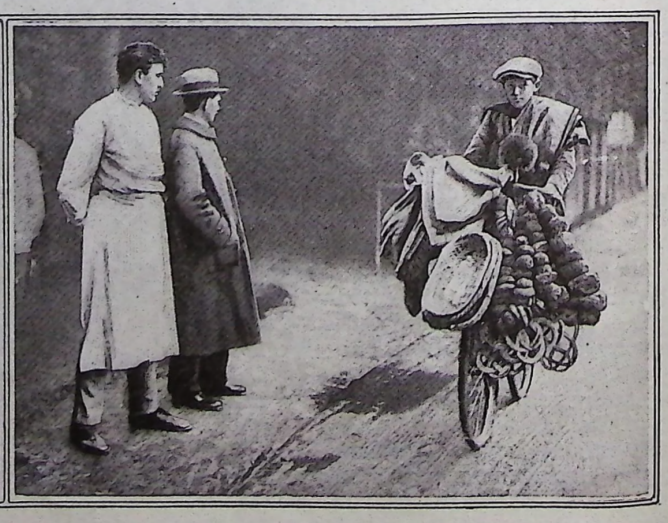
Each one of the bricks was wrapped in brown paper and sent out as dinner invitations, via parcel post, by the Campaign Committee of the United Building Campaign Fund. As a result of their efforts in this and other ways, $10,000,000 was raised.

He Pedals as He Peddles

SPONGES, feather dusters, carpet-beaters, dust-brushes, and wicker baskets are light things to carry, though clumsy. A Dutchman decided to peddle them, and instead of buying a flivver or a horse and wagon, he used his bicycle as a delivery wagon.

He hung hundreds of sponges on the left side of his front wheel, and many bags and brushes on the right side. In front he spread the baskets, and over his shoulders more bags. Though his wares may very easily trip him up. he at least will be sure of falling on something soft.

© Keystone View Co.



© Press Illustrating Service

A Boy at the Tread-Wheel Irrigates the Fields

EACH country has its own ideas on irrigating dry fields. In China, for instance, it is sometimes done in the peculiar fashion shown above. A water-wheel is mounted in a small stream at right angles to the flow of the current. The water won't turn it over and so a small boy does it tread-wheel fashion.

He holds on to a pole sunk in the water, and pushes the wheel around by stepping on to the ends of the blades. The water is then forced through a trough leading to the fields that need irrigating.

One way to develop a Marathon runner —but pretty tedious after the first hour!

It Was Here Before Columbus

ON a farm near Rosewell, N. M., is an irrigation ditch, or rather a raised irrigation canal, which is one of the oldest evidences of man's inventive powers on this continent. It was built centuries before Columbus learned navigation. The walls of the canal are believed to have been made of sediment taken from a near-by spring, a clay-like material that exposure to the air has made as hard as stone.

The making of two blades of grass to grow where but one grew before through irrigation is a very ancient practice. It was carried on crudely by the Egyptians at least as early as 2,000 B.C.

When You Walk the Ladder Step Goes with You

THERE is now a ladder that has just two steps, one for each foot. As you climb you take the steps with you. There is a pocket in each step into which your foot fits snugly.

The slots along the sides of the ladder in which the steps slip up and down are provided with ratchets that will hold the steps in a fixed position whenever you press down on them. Thus by dragging one foot after the other you can adjust the steps to suit yourself.

How do you get down again? We are not quite certain, but we presume that you reverse the action.

Selling to the Man Higher Up

"ICE cream cones, five cents each!" shouted the small boy standing alongside of the bus. Several passengers on the upper deck looked down longingly at the tray of cones below, when, behold! the tray of cones shot up within their reach. The boy had mounted his tray on a long pole in order to get the trade of the men and women higher up—and he succeeded.

While the bus riders waited in the hot sun for the bus to start they fell easy victims to his plan. And he gathered in the nickels. Or perhaps he charged a dime. Ice cream, like everything else, has become more expensive, and besides, this boy's business is a risky one. Ice cream melts quickly in the hot sun.

Should two or three bus loads pass him up, the ice cream in his cones would run down into the tray and the result would be a total loss.

When this picture was taken there were just four cones on the tray, and eight people on top of the bus. His chances of selling out seem good.

© Gilliams Service

No Smuggling on the Rhine!

PUT! Put! Put! Put! The modern watch on the Rhine pricks up his ears. A launch is running without lights somewhere in the river. He passes the word, a searchlight begins to feel around in the velvety blackness, and a launch flashes into view as the brilliant beam picks it up. The sentry hails the boat, but gets no reply. Instantly a rattle of machine-gun shots rings out on the night air, and the boat stops.

The combination of machine-gun and searchlight was invented by the British forces to break up smuggling on the Rhine. When the light plays on an object the gun is automatically trained on it.

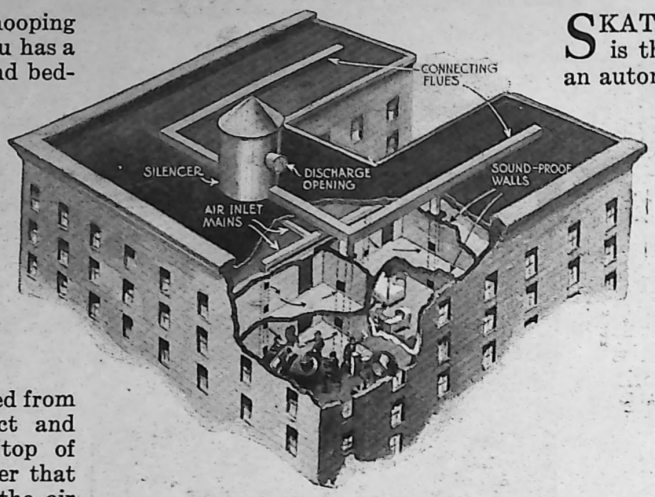
The gun and the searchlight are mounted side by side on a common stand and turn on the same axis. When the searchlight is turned about to pick up a boat, the gun moves with it. When the boat is spotted, the gun is ready for action, if necessary.

Here's Maxim's House of Silence

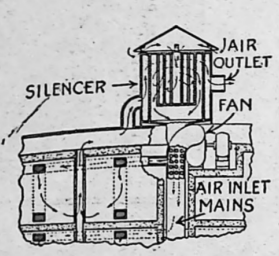
THE baby below you has whooping cough; the man above you has a pianola; and both tune up around bedtime.

But Hiram Percy Maxim, the well known inventor of the silencer for firearms, has come to the rescue. Be not alarmed, he does not intend noiselessly to shoot your neighbors, but to apply his silencer idea to the apartment-house itself. He would build apartment-houses, hospitals, and hotels so that the windows need never be opened. Air is furnished from the roof through a main duct and several branching flues. On top of the main duct there is a silencer that breaks up the noise waves in the air which is entering. As it goes into the silencer it passes through a series of spirals which are enclosed in an inside chamber made of sound-deadening material. By the time the air finally reaches the main duct all the noise has been taken out of it.

In the duct there is a fan for forcing the air down and a coil for heating or cooling it. In winter the coil is filled with steam and in summer it is filled with a refrigerant. The fresh-air openings are near the ceilings of the rooms and the flues for carrying off the foul, used air near the floors.



With the windows closed and the air coming through a silencer on the roof, you will not hear your neighbor's pianola or his baby



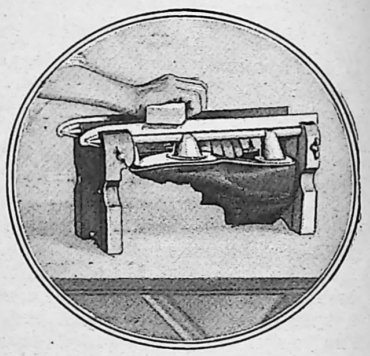
As noise waves enter the silencer, they pass through a series of spirals enclosed in a chamber made of sound-deadening material

Why Not Sharpen Your Own Skates?

SKATES dull easily and the result is that you skid on the ice just as an automobile does on wet pavement Every skater should own his own sharpener.

The picture below shows an individual skate-sharpener that has recently been invented.

To use this skate-sharpener, first turn your skates upside down and fit them into grooves in a small wooden stand. Tighten them in place by means of screws, and then rub the upturned edges with a sharpening bar.



Sharpen your own skates as easily as you shine your shoes

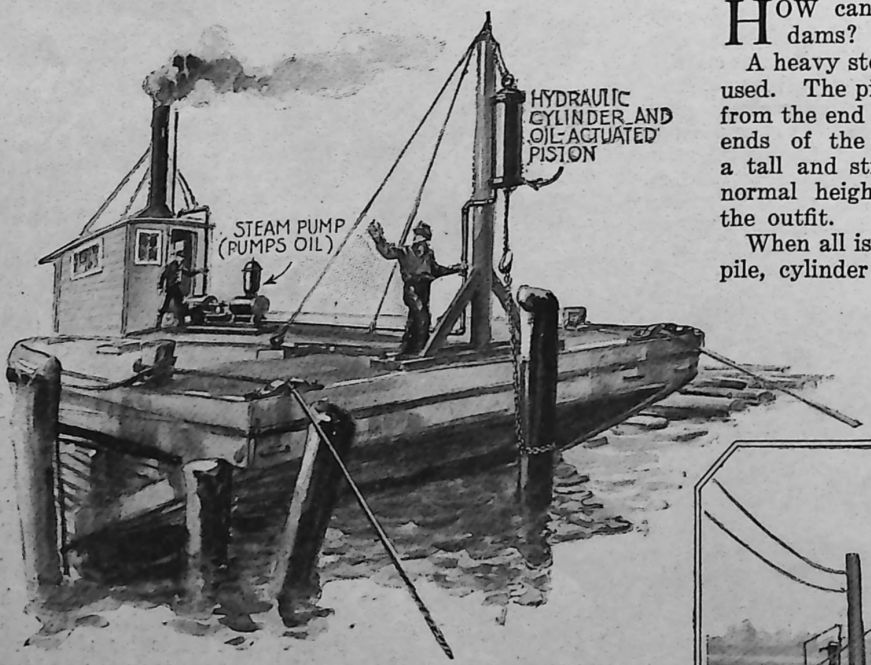
Sheet Piling May Be Pulled Out by Hydraulics

HOW can you pull out sheet piling used in cofferdams? One ingenious method is shown herewith.

A heavy steel cylinder with pipe fittings and piston is used. The piston-rod, with a hook on the end, protrudes from the end of the cylinder to engage the holes in the ends of the sheet piles. The cylinder is attached to a tall and strong spar at a height sufficient to reach the normal height of the pile-holes. A pump completes the outfit.

When all is ready, with the hook engaging the eye in a pile, cylinder oil is pumped into the lower end of the cylinder, and the piston pulls the hook upward.

With eight tons of lifting power the device is capable of moving almost anything that can be driven.



Piles may be pulled out of deep water by mounting pump and spar on a scow. The device has a lifting power of eight tons

The small cylinder attached to the spar will pull up sheet piling; a piston in the cylinder has a hook on the end that fits into the eye in the pile; oil is pumped into the cylinder and the piston easily pulls the pile up

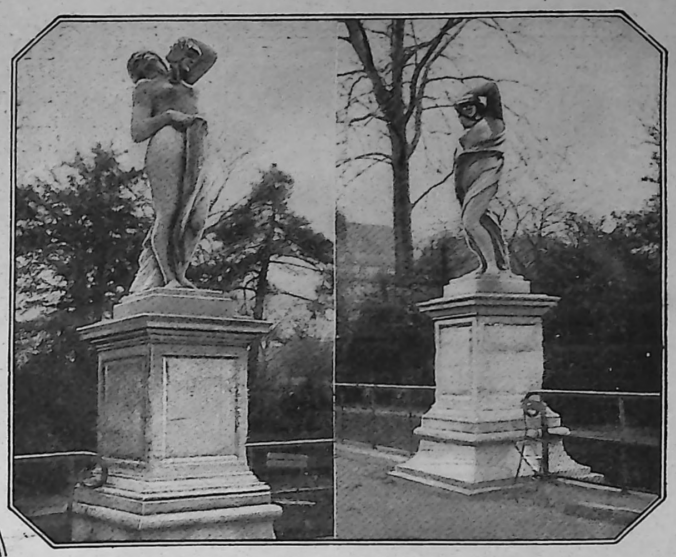
Put a Burglar Alarm on Your Baby

KIDNAPPED—not by Stevenson but by a burglar; many mothers are constantly in fear of having this happen to their babies. They always keep a watchful eye on the baby-carriage. Why not attach a burglar alarm to baby and carriage? This has been done, as you will see if you look at the picture below.

Fastened to the carriage just below the handle there is an electric bell with wires running down from it to a battery below. When the mother leaves her child she sets the alarm. Along comes the burglar. Should he start to wheel the carriage away the bell will ring loud and long. Or should he notice the alarm and decide to remove the baby from the carriage he will be foiled again: the alarm is also attached to the baby.

No one can steal this child without setting off an alarm; the alarm is attached both to the carriage and the baby

© Press Illustrating Service



From one angle this statue of a woman smiles at you derisively; from another you see the mask torn off and face and body tense with anguish

Turns Two Faces to the World

AS you walk through the Garden of the Tuileries in Paris, you come upon the statue of a woman who slouches carelessly on her pedestal and looks down at you with an unpleasant, derisive grin. But if you walk around her you will see the real woman with the mask torn from her face.

Her head is thrown back in anguish, her teeth clenched, and her eyelids drooping with pain. Her body is no longer slouching but tense. She holds the mask in her left hand.

This remarkable statue was first made in clay sixty-five years ago by Ernest Christophe, who called it "Sorrow."

Twenty-one years later Christophe remade the statue in marble and gave it a new name—"The Mask."

Bats Made of Wood Strips and Glue

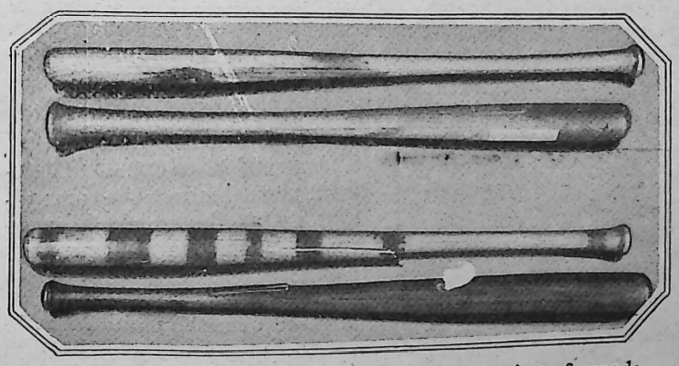
A NEW baseball bat, bidding fair to make its appearance in major baseball, has been developed at the Forest Products Laboratory, Madison, Wis.

It is made by gluing together strips of wood obtained from board edgings and waste stocks. The strips are selected to give clear material and are dressed to a smooth surface before being glued together. The moisture content is also equalized. The laminations may vary in thickness from a half to three quarters of an inch.

The photograph below shows several bats made by gluing together three laminations, three quarters of an inch thick and two and a half inches wide. Two bats, as shown in the picture, failed while being used.

In both cases the failure occurred in the wood, while the glue held unbroken, even under the severe pounding the bats received.

The laminated bats seemed to give as good service as the solid bats on the field, and the players showed no preference for one kind over the other.



These bats were made by gluing together strips of wood; in the two imperfect bats the wood cracked—not the glue

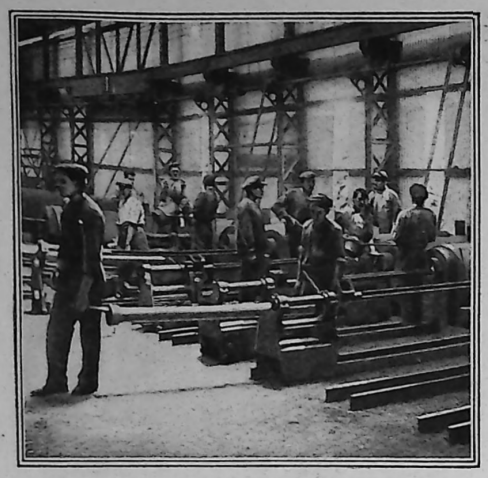
Here is a collapsible stove for campers. The grate is mounted on a rod and opens up umbrella fashion

Here's a Stove that Opens Up Like an Umbrella

"LET'S go camping—build a fire in the woods and cook our dinner on it," someone says. And then you remember how last time somebody kicked the log you were using to prop the coffee-pot, and over it went—just as it was going to boil, too. And you jumped to save it, and tipped over the frying-pan, and its contents were unfit to eat. "No! Give me a good steady stove at meal-time," you reply.

Now Roderick D. Turner and Walter G. Dedolph, of Mount Vernon, Washington, have together invented a camp-stove that is the very thing you need. When not in active service it can be folded up like an umbrella and carried just as easily.

A central rod is driven into the ground and supported by a tripod that has adjustable legs. Mounted on the central rod is a collapsible grate that may be opened up and flattened out. You rest your pots upon it. The grate is supported by wires from the central rod. The whole stove weighs but ten pounds.



Hot iron is poured into these machines and whirled into pipes by revolving molds

Whirling Molten Iron into Pipe

IF you whirl a string with a weight on the end and then let go, what happens?

It flies off at a tangent. This is caused by what is known as centrifugal force; and the same principle is applied to many pipe-casting machines.

The hot iron is poured into the machine, and it lands on a whirling steel mold that is properly cooled.

The liquid is flung against the sides, hardens, and comes out a perfect pipe. The pipes that are made in this way are of uniform thickness, and, though thin, are very strong.

How Will You Have Your Gas?

JUST as we get expert in sight-reading the gas-meter, along comes an Englishman with a new scheme for measuring the gas we burn. He proposes that it be sold by heat units instead of by the cubic foot.

This doesn't mean that the gas-meters will be scrapped. They will go merrily on registering cubic feet, but in order to understand your bill you'll have to translate that into heat units.

To do this you have only to remember that the unit of heat measure is the quantity of heat required to raise a pound of water one degree Fahrenheit. If, then, when Polly puts the kettle on it contains two pints of water, it will require 380 heat units to bring the water to the boiling point—212° F. It is proposed that the new "gas unit" shall contain 100,000 such thermal units, so that one "gas unit" will have sufficient heat to boil two hundred and sixty such kettles as Polly put on.

You Can Tuck This Piano Under Your Arm

"OH, what a pal was Mary!" sounds just as convincing on a small sixty-pound piano as it does on a baby grand—particularly so since the tone of the new small piano is harp-like, and Mary is dead.

What does this tiny piano look like? The picture below will show you.

It is so small that soldiers at the front were able to tuck it away in their equipment and take it out whenever they had a few hours' rest. The piano has a regular five-octave range, but tuning-forks instead of strings are used to produce sound. This, of course, does away with the necessity of tuning the instrument.

When you strike a key, a hammer drops on a tuning-fork, which is set to vibrating and produces a tone.

The fork is connected by a spring to a sounding-board that reinforces the tone.

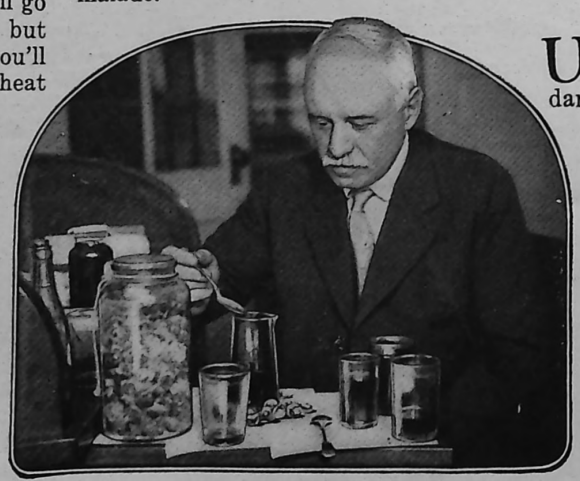
The piano is also equipped with a loud pedal. When you step on it a damper that rests on the end of one arm of the fork is raised, and the fork is free to vibrate loud and long.

This tiny portable piano weighs but sixty pounds; it has a full five-octave range, but the tones are produced by tuning-forks instead of strings

Saving Fallen Fruit

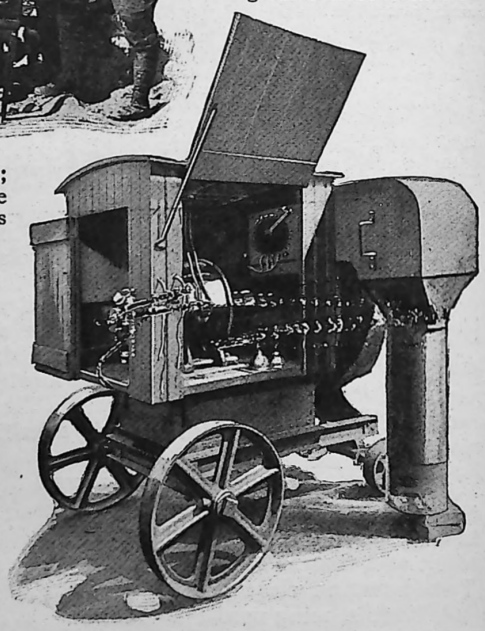
WHEN a strong wind blows, a large number of lemons, oranges, and grapefruit that are nearly ripe drop to the ground. Many are bruised, and many more are instantly attacked by ants and worms. The fruit is a total loss unless quickly gathered.

If they are picked up promptly, the uninjured parts can be turned into by-products. The lemons can be used to make lemon oil, citric acid, citrate of lime, and dried lemon peel; the oranges will yield vinegar, marmalade, syrup, and orange butter much like apple butter; the grapefruit, juice and marmalade.



He is testing out by-products made from bruised lemons, oranges, and grapefruit

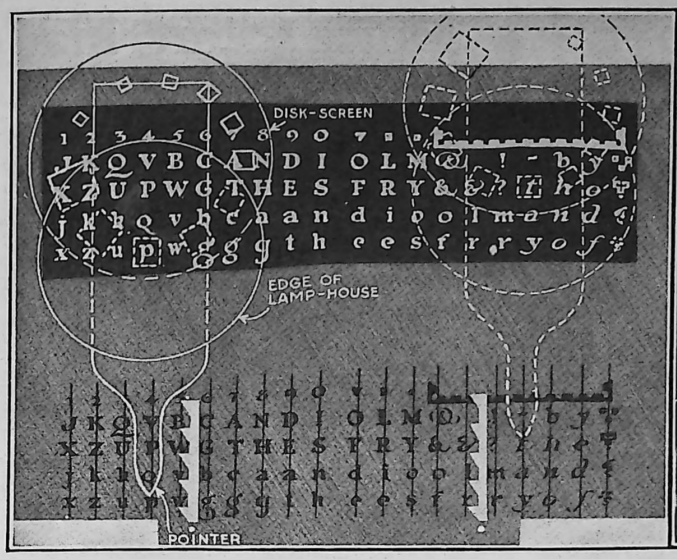
Constructed to cool off overheated underground electric cables



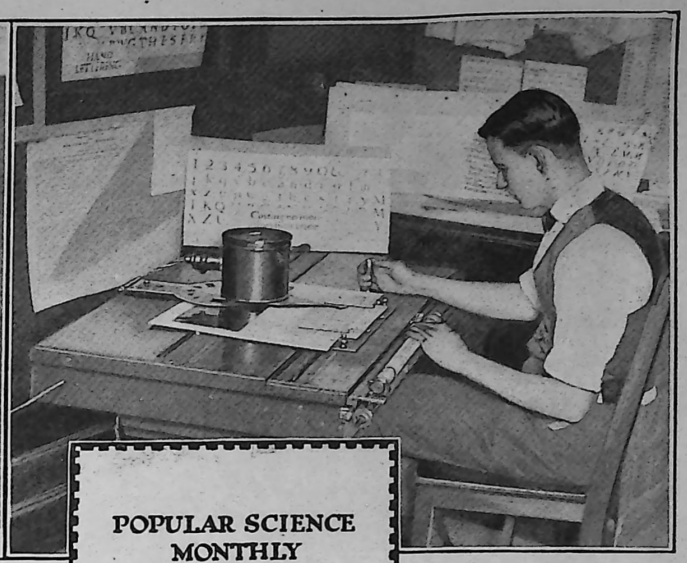
Cooling Off Underground Electric Cables

UNDERGROUND electric cables frequently become heated to the danger point. A company in Detroit has constructed a portable blower that will cool the cables.

The blower is equipped with a twenty-eight-inch fan connected to a 7.5-horsepower motor. A discharge pipe from the blower is inserted in a circular sheet-iron plate having the same diameter as the manhole to be covered, and the two are then cemented together to make an airtight joint. The circular plate is fitted over the manhole nearest to the overheated section of the cable, and the motor is started.



The upper part is an ordinary film negative upon which has been photographed an alphabet of type. The lower section serves as a guide for the pointer, the upper part being covered by the lamp-house when in use



The operator prints letter after letter by simply moving the negative and pulling a lever. The display card on the left demonstrates that the machine allows as great latitude in the spacing of letters as does hand work

POPULAR SCIENCE MONTHLY

Science
Engineering
Mechanics
Invention
Automobiles
Radio

Hand Lettering by Machine

WHILE printers may readily set up advertisements and cards on linotype and monotype machines, it has always been difficult to prepare those displays which are to be photographed on copper and run as a solid block—a half-tone engraving. It is to fill this missing link that Isaac Bunnell of New York has invented the desatype.

The machine does lettering, the same sort of lettering that an expensive artist does, and in about one tenth the time. Moreover, its range in style of lettering is much greater than the ordinary artist possesses, for, in fact, it uses the best work of all artists. Practically anything that a graduate professional can do, the machine can do, and keep it up in unending variety all the day long.

The operator first clamps a rough dummy layout on a platen at the point shown in the illustration. Then from his file he selects the type-card which carries the style of lettering called for in the dummy. These type-cards are negatives, and a complete set of them, like fonts of type, contains the various sizes and styles of letters. The selected card is put in the machine and moved around until the letter desired, "P" for example, falls under the index, or pointer. The operator then knows that the "P" on the film part of the type-card is under the lamp-housing, ready to print.

Pulling on a short lever at his right, the operator causes the lamp within the housing to light up and send its rays down through the clear place in the negative and so print the letter the clear place corresponds to—suitable sensitized paper being mounted on a roller beneath the lamp-housing in such a way that it can be affected properly by the oncoming rays. Adjustment of another lever sets the apparatus over one space, ready to print the next letter, and in this way the process continues. An automatic timer on the lamp gives each letter equal exposure.

After the printing of the layout is completed, the part of the sensitized paper used is torn off its roll, and developed and fixed just as ordinary "slow" photograph prints are handled. Immediately the black lettering stands out on a white background, just as if a professional artist had done it.

How They Are Chasing the Rats Out of England

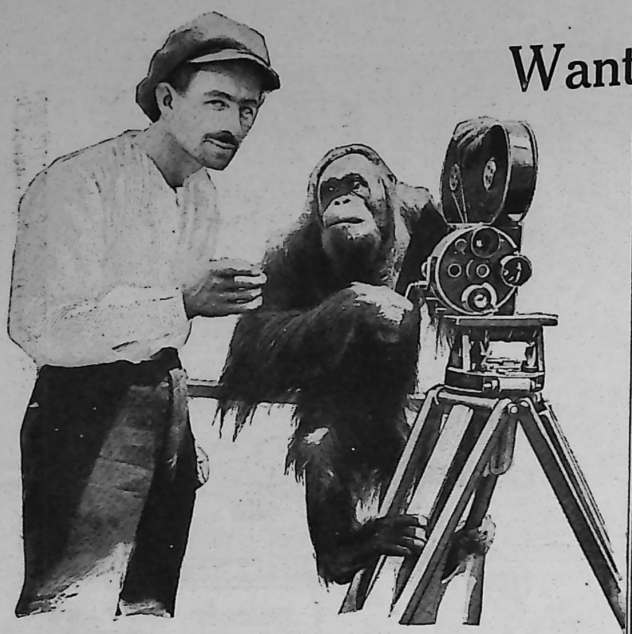
ENGLAND'S full of them—the black Irish rat, the brown Alexandrine rat, the common brown rat, and ye olde English black rat. As a result England has had a rat drive, scheduled to last a week—the week being officially called "Rat Week." Besides using traps and poisons to get 'em, ferrets were put on the job. Here you see three ferrets ready to start on a tour through a huge woodstack at Aldershot.

This is, briefly, the history of England's rats: until the first half of the eighteenth century the old English black rat reigned supreme; but then the common brown rat invaded the country, coming by boat from somewhere in Central Asia, and bringing with it the bubonic plague. This fierce little animal nearly exterminated its black brothers.

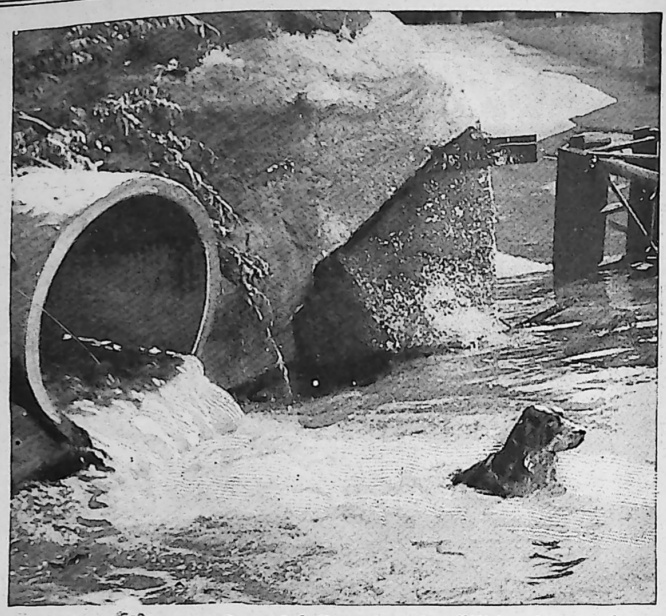
During "Rat Week" in England, ferrets were set on the trail of many rats; those shown here are ready to tour through a woodpile

The brown Alexandrine rat was imported later. As for the Irish rat, it is a black variety of the common brown rat and is not seen very often. Whether native or foreign, rats are great disease-carriers as well as voracious guests at the nation's table.

Want to Be a Movie Star, Fido?

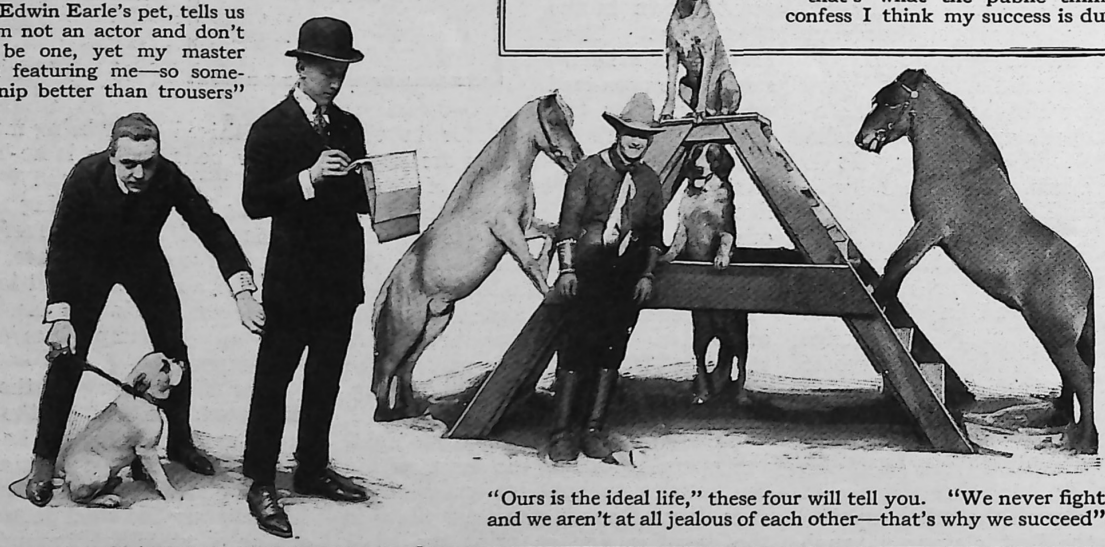


Says Joe Martin, orang-outang: "Follow master—that's my motto; I copy everything he does. As you see, today, instead of acting, I'm the camera man; by being able to help out in a pinch, I have made myself quite valuable—and really these men's jobs are simple"

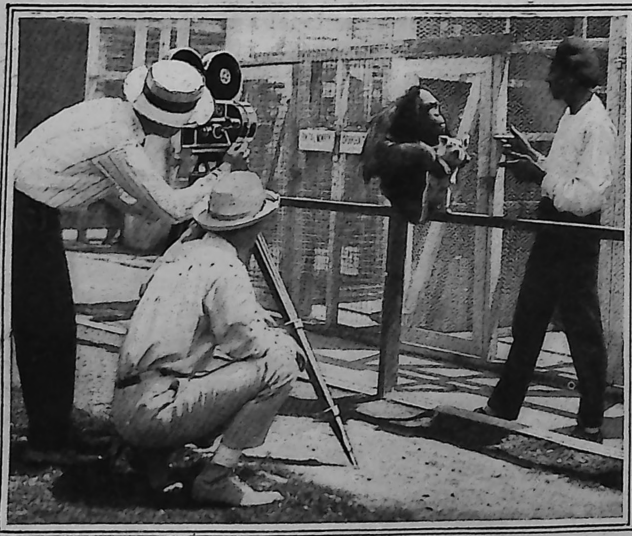


Imperial Cæsar's tale: "This picture shows —that's what the public think. I'm the confess I think my success is due not to my

Murphy, Edwin Earle's pet, tells us this: "I'm not an actor and don't want to be one, yet my master insists on featuring me—so sometimes I nip better than trousers"



"Ours is the ideal life," these four will tell you. "We never fight and we aren't at all jealous of each other—that's why we succeed"



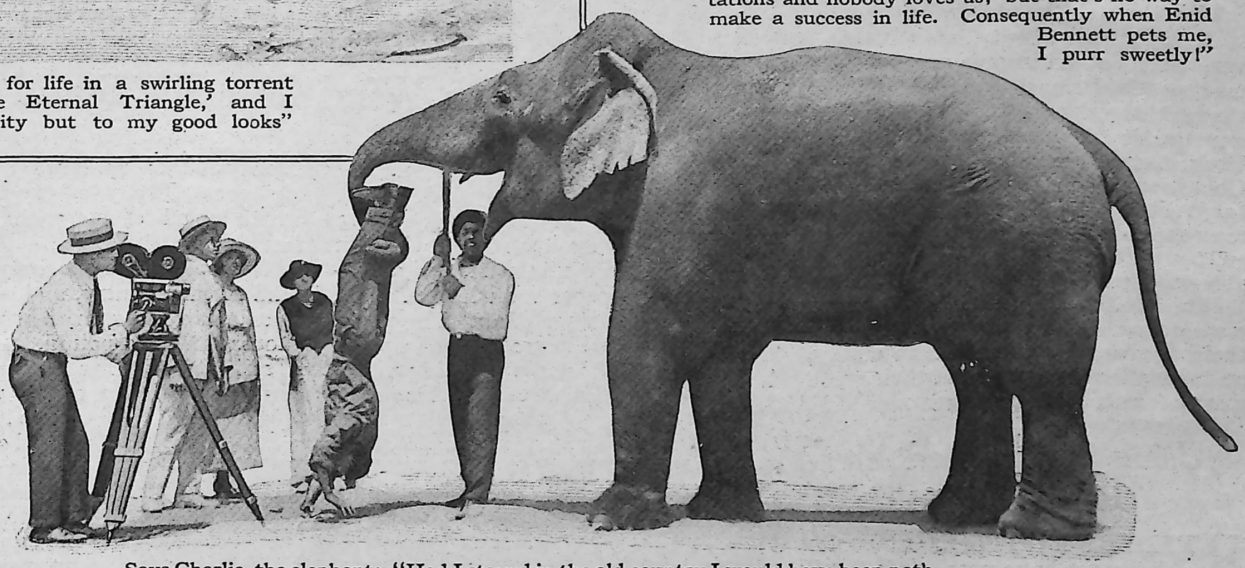
Here's Joe Martin again; he's going to give the baby pig a bath under a hydrant spout. Joe says, "Curly Stecker has really taught me nearly all I know; he is a very good trainer: but then, you know, I film well"

Says Kazan: "I am a full-blooded Russian wolf-hound and thank my parents for my beauty—I might have been a cur! Good looks do help in the movies, but I have incidentally cultivated a most fascinating smile"

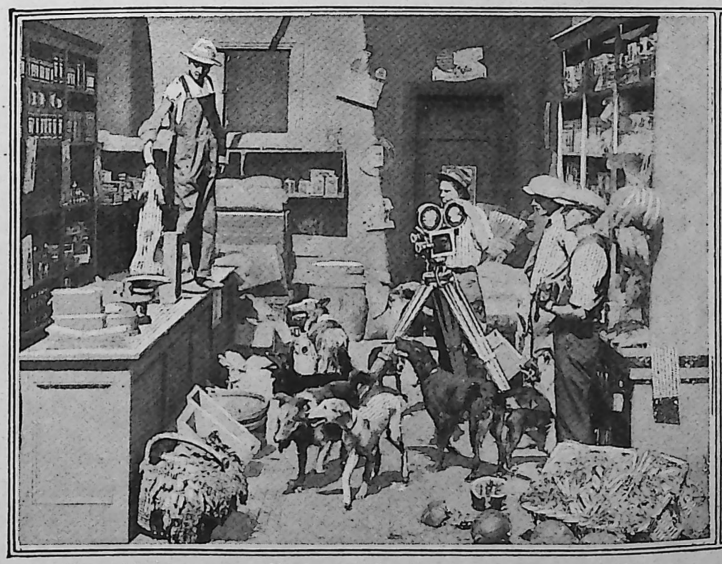
We'll Tell You How to Do It

me struggling for life in a swirling torrent hero in 'The Eternal Triangle,' and I histrionic ability but to my good looks"

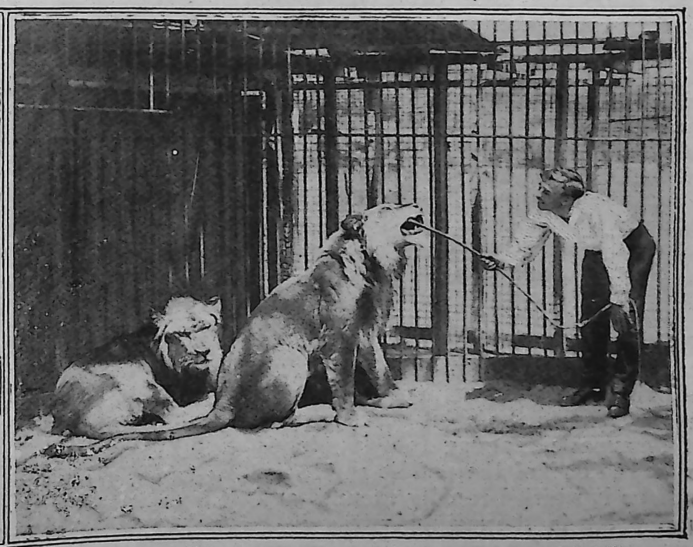
Here's baby tiger's tale: "We tigers have fierce reputations and nobody loves us; but that's no way to make a success in life. Consequently when Enid Bennett pets me, I purr sweetly!"



Says Charlie, the elephant: "Had I stayed in the old country I would have been nothing but an ordinary laborer: here in America I am an actor of no small fame. I have a fine memory and so this movie game is all very simple—one rehearsal is enough for me"



The extras speak: "All morning we were starved; then they let us loose in a grocery store and we made for the pieces of raw meat that we smelled. All the while the camera man was grinding away. Foolish, don't you think?"



Ethel says: "Once I lived in a Zoo; but that easy life kills ambition, so I got out before it was too late. I went into the movies and have starred in 'The Lion's Claws,' 'Lost in the Jungle,' and 'The Lure of the Circus'"

© International Film Service Co.

He looks like Santa Claus, and he is one; all through the year he makes Christmas toys; thus he is able to earn his living

Toy-Makers in Santa's Work-Shop

ALL through the year, when you have forgotten all about Santa Claus, eighty very old men and women are patiently making Christmas toys. They had thought they were too old to be of any use in the world until the New York Association for Improving the Condition of the Poor started a small toy factory for them. The finished toys are sold in a store and the profits go to the workers. Thus they are able to earn a living.

When the factory was started there were only about ten workers, but now their number has increased to eighty, and they have moved from their small work-room to a much larger one.

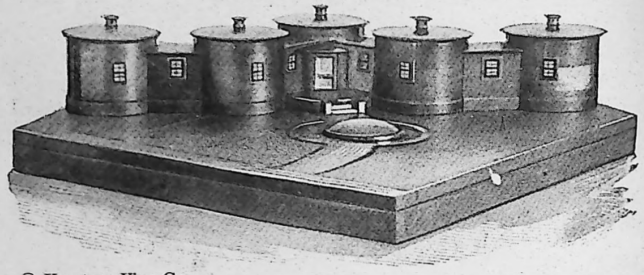
Using Compressed Air to Mix Paint

READERS of the POPULAR SCIENCE MONTHLY have been made familiar with "paint-guns," which eliminate laborious brush-work on rough jobs by using compressed air to spray the paint on the surface to be coated. Now an ingenious workman has called in compressed air to save the back-breaking labor of stirring paint. In his shop, as in many others, a large supply of paint is kept always on hand. It is necessary to stir the paint from time to time to keep it properly mixed and ready for service.

There happened to be a high-pressure air supply handy to the paint-room, so the workman rigged up a double wooden paddle for each paint-tub with the paddle shaft projecting above the top and held in place by cross-pieces. When the paint needs stirring a pneumatic reaming tool is slipped over the end of the paddle shaft, the paddle is whirled rapidly around, and the paint is thoroughly mixed in a surprisingly short time. It is necessary only to shift the reaming tool from tub to tub to stir the whole lot.

Should Home Look Like This?

"SQUARE houses belong to the devil." This startling statement was made by Mr. C. N. Wisner, a New Orleans inventor—not in a campaign against the landlords of apartment-houses, but in behalf of the new round house Mr. Wisner has invented. A model of one of these houses is shown below. At first glance it looks like five pots with their lids clamped down, but you soon notice the windows and the halls that join the rooms together, each seeming pot representing a room. You can start with one, and add one by one as you wish. They are made of concrete cast in steel molds.



© Keystone View Co.

These are not five pots linked together, but five rooms, hallways, and closets—a model of what the inventor calls the perfect house

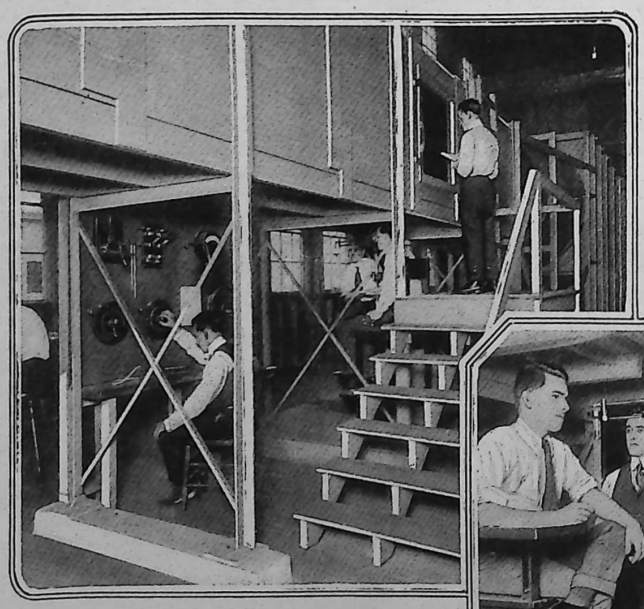
How Much Wind Can She Stand?

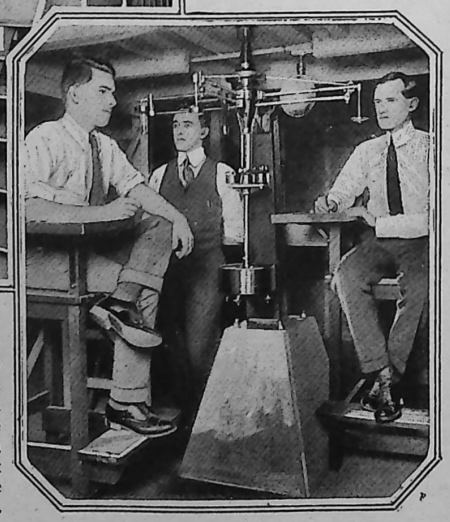
WHIR! Whiz! The wind shot through the wind-tunnel, and the small airplane quivered. Just below her, two men glued their eyes to a strange-looking instrument known as an aerodynamic balance, and alongside of her another man looked in at her through a glass window. They were testing her to see how she stood up under the force of wind of varying velocity. A fourth man regulated this speed.

The airplane is a tiny model, one twenty-fourth as large as a regular airplane. The wind-tunnel runs the whole length of the room and is four feet square.

The balance is the only one of its kind in the country, and is so accurate that it can measure to within one ten thousandth of a pound. By adjusting a series of weights the men can determine the effect of the wind on the airplane. The whole outfit is located in the Massachusetts Institute of Technology, and it was used by the army and navy throughout the war.

Photographs © Wide World Photos





The man on the landing is looking through a glass window at a small model airplane fastened inside of a wind-tunnel; the man to the left is regulating the speed of the wind that he is sending through the tunnel; and the two men directly under the spot where the airplane is fastened are reading an aerodynamic balance that tells the effect of the wind on the airplane. They can be seen more plainly in the picture at the right.

One of the Great Unknowns

This Edison of the rifle-barrel won't quit work till he quits life

By Herbert Asbury

BOARD a tunnel train under the Hudson river, and get off at the Exchange Place station in Jersey City. Then walk down Hudson street, perhaps the dirtiest and noisiest of all the dirty and noisy streets of Jersey City, until you reach Morris street, in the midst of a multitude of machine-shops and foundries whose clangor and clamor is never stilled, and within sight and sound of the bellowing steamships that line the Jersey City docks and piers. Walk down Morris street to No. 18, a dingy and dilapidated old structure, and climb the stairs to the fifth floor. And there, while your ear-drums are assaulted by the screeching whine of a planing-mill on the same floor, you'll see at the head of the stairs a sign:

POPE'S BELL

Bell out of Order. Knock on the Glass

You knock and knock, and then you knock again, trying vainly to compete with the planing-mill and the noises of machinery that come filtering up the stairs. But finally the planing-mill subsides for an instant, you pound on the door with all your might, and suddenly it is opened by an old man with very gray hair, a homemade cigarette drooping from his lips, a little black cap on the back of his head, and a twinkle in his bright gray eyes.

He is the Edison of the rifle-barrel. His name is Harry M. Pope, and he is hard to find.

Truly he is a prophet without honor in his own country. He is known wherever rifle experts gather and wherever fine rifles and fine ammunition are manufactured; but in his own home town the rank and file of the population—and the big business men, too—never heard of him. He has lived in New Jersey for almost fifteen years, and in all of that time his work-shop has been in 18 Morris street—but his name does not appear in the city directories, nor in the telephone directory, and the Chamber of Commerce of Jersey City has no record of him. The writer succeeded in finding him only because an ancient gunsmith on the outskirts of the city happened to remember his address.

The shop in which Mr. Pope manufactures fine rifle-barrels and does the delicate work of adjustment seems to an outsider to be cluttered with tools in hopeless confusion. But there really isn't any confusion at all; he just hasn't room for all his tools. Every nook and corner of the place is jammed with lathes and punches and dies and tools of all sorts—with the exception of a small space in a corner.

That space holds a rather dilapidated couch, with a faded blue necktie thrown carelessly upon it, and a pair of heavy army shoes peeping from beneath it. This is where Mr. Pope does most of his sleeping—when it occurs to him to sleep. He doesn't sleep a great deal; he thinks, with Edison, that it is a waste of time.

The shop may seem to you to be a hopeless clutter of confusion. It is not. The fact is, Mr. Pope hasn't room for all the lathes and punches and dies and other tools necessary in his business of making rifle-barrels

He eats regularly if he happens to think of it, otherwise only when he becomes so hungry that the matter of food intrudes itself. He has a home, of course, and a family,—two of his boys were in the American Army during the war,—but he is so much in love with his work that he sleeps in his shop some four or five nights a week.

"But I'm getting a little tired now," he said, "what with all this noise and so much work. I'd like to be in the country for a while."

"Are you thinking of retiring?"

"Retire!" exclaimed the wizard of the barrels indignantly. "I'll retire when I'm dead! What I meant was that I'd like to have my shop in the country, where I could get a bit of fresh air."

The postmarks on the great mass of letters piled on Mr. Pope's work-bench demonstrate that, if without honor in his own country, he certainly has great honor in Canada and in California and Maine and all of the other states of the Union.

Mr. Pope has known and loved rifles all his life.

"I began shooting when I was a kid," he said, "and I've been shooting ever since. I had a hard time finding a gun that would shoot like I wanted it to shoot, and like I knew it ought to shoot, so I went to work and made one. I liked the work so much that I kept at it."

Manufacturing rifle-barrels is about everything that Mr. Pope does. Repair work is distasteful to him, and repair work on barrels is the only thing of that sort that he will do at all. His delight is to take a perfect action direct from the factory and fit that action with a barrel of his own making—and the combination is a gun that wins championship matches. He has made many rifles of that sort; for, after all, it is the barrel that determines whether a weapon is a rifle or merely a piece of junk in the form of a rifle, and some of the guns that he has made have been considered by experts the finest in the world, and all of them in the hands of marksmen have brought home record scores and medals galore. Many of these prizes and medals the visitor will find hung on nails in a corner of Mr. Pope's work-shop, because he can shoot about as well as he can make rifle-barrels, and has won many big rifle tournaments.

Mr. Pope is a native of New Hampshire, and possesses a little more than his rightful share of New England reticence. Like all true artists, he is modest. However, it was learned, by dint of persistent questioning, that he has been making rifle-barrels for more than thirty years. He has had shops in various New England towns, and once went to the Pacific coast. But he lost everything he had in the San Francisco earthquake, and then returned to the East and settled in Jersey City.

Even if he achieves that dream of a place in the country, he probably won't see very much of it, because the most striking impression that one gets of Mr. Pope is that he will continue to work with his rifle-barrels for eighteen hours a day as long as he lives.

She saw the burglar coming, and pushed two buttons concealed on her bed; then she threw up her hands as requested

Announcing Mr. Burglar

"BULLET Johnson," burglar, ransacked the ground floor of a house in Philadelphia and then invaded the owner's bedroom. "Keep your hands in sight and your mouth shut," said he, and his victim promptly obeyed. A few minutes later "Bullet" left the house, and several policemen ran out to meet him. He is now serving a five-year sentence in prison.

How did the police find him out? In the side of his victim's bed two push-buttons were literally embedded. When the woman in bed heard the door creak and saw it move as the burglar entered, she pressed both buttons, one of them once, the other twice. A bell rang in the house on each side of her, and the neighbors woke up and called the police.

Wilfred B. Henderson originated the idea.

His house was one of eighteen on his block, and there had already been six burglaries near by. He suggested that electric bells with push-buttons be placed on one of the beds in each house, and that they be wired together, so that each house might ring up the houses on each side should a burglar appear. One ring means the house on the left and two the house on the right.

Can You Name the Seven Seas?

OMAR KHAYYAM and Kipling both talk about the Seven Seas. What are these Seven Seas?

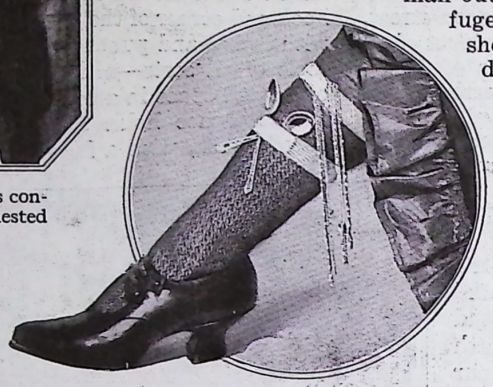
They are really the five oceans—the Arctic, the Antarctic, the Atlantic, the Pacific, and the Indian oceans. And the number seven is derived by dividing the Atlantic and Pacific oceans into halves, and calling these halves the North and South Pacific and Atlantic oceans.

The reason for this is supposed to be that the number seven symbolizes completeness or perfection. As early as the beginning of Christianity, the rabbis affirmed that "God made the Seven Seas."

Shop-Lifting Up to Date

"LET me see that necklace in the case over there," says the lady to the salesman. He goes after the necklace and brings it back; she decides not to take it, and goes out.

Shortly after she has gone various articles are found to be missing. They went with the lady, who was a shop-lifter. The method of working was to get the salesman out of the way by a subterfuge. While he was gone she "accidentally" knocked down sundry small articles, which she kicked close to the counter. Shortly afterward, under cover of tying her shoe-lace, she transferred them to a couple of strong elastic garters that she wore around her legs. After her real business had been accomplished the proposed purchase, of course, no longer interested her.



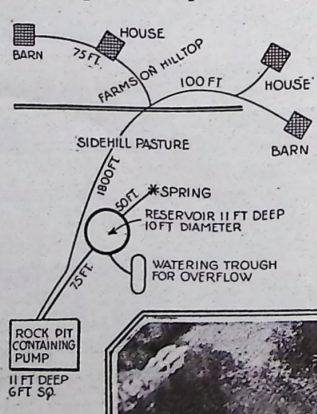
A shop-lifting device that emanates from England; London stores suffered accordingly

Harnessing a Spring to Pump Itself

BY harnessing a spring so that it pumps itself, two farmers who live on opposite sides of the road on an Iowa hilltop near the Mississippi river have running water in their homes and barns. Their farms lie on top of the hill. The long timbered slope of the hill is owned by one of the farmers and used as a pasture. Near the top of the hill a spring bubbles out of the limestone.

The spring was cemented in to keep out impurities. Fifty feet below, a cement reservoir eleven feet deep and ten feet in diameter was built in the ground and the water from the spring piped to it. Seventy-five feet down the ravine from the reservoir a square rock-pit eleven feet deep was made, and an automatic pressure pump installed in it. A two-inch pipe was laid underground between the reservoir and pump. From the pump a smaller pipe was run to the top of the hill, a distance of eighteen hundred feet and a lift of four hundred feet. At the top it branched into two p pes.

The system works automatically. Open any one of the faucets on the two farms and the pump begins to work. The water, as it drops through the pipe from the reservoir to the automatic pressure pump, works against the piston with a pressure of forty-five pounds to the inch, driving the piston with a force that sends the water uphill. When the faucets are closed, the back pressure of water holds the piston so that it cannot work.



The water from the well above is automatically pumped to two farms. The pump is enclosed in the house to the left. When any faucet is turned on the water works against the piston of the pump

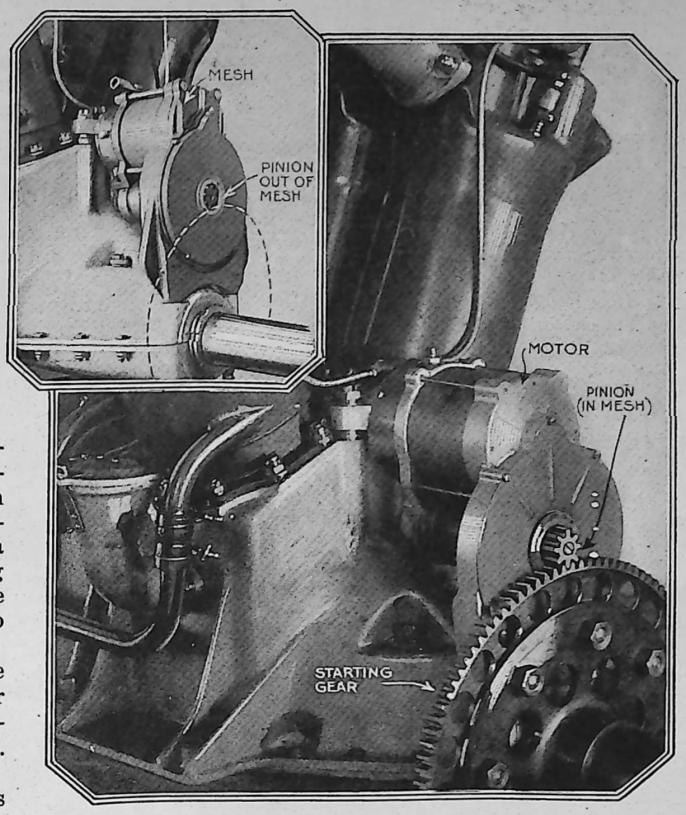
Self-Starters for Airplanes Introduced by the N. C. Craft

EVERYONE who has read the magazine sections of the Sunday newspapers during the past year knows that the engines of airplanes are started by man power. You have probably seen pictures showing a team of three or four men, hands linked, starting the propeller, the outside men pulling the man who actually turned the propeller out of the suction of the revolving blade at the critical moment.

With millions of automobiles equipped with self-starters, the question has often been raised as to why airplanes were not fitted with a similar device. One thing that prevented this was the additional weight necessary to install such equipment.

All these problems have been overcome by a starter manufacturer, the first apparatus being fitted on the N. C. boats.

The new apparatus consists of a small twelve-volt motor operated by a storage battery weighing twenty-six pounds.



Now comes the self-starter for airplanes, a feature long needed by pilots. No more danger of injury to the mechanic if it is attached to your airplane

The current revolves the armature shaft of the motor. A small pinion on the end of the armature shaft drives another small eight-toothed gear, which meshes with a larger gear attached to the propeller-shaft, so that the engine-shaft and propeller are automatically started. The starter turns the engine at from forty to fifty revolutions a minute, and the storage battery has sufficient capacity to start the engine one hundred and fifty times.

The pinion on the drive-shaft does not mesh with the shaft gear until the starter button is pushed, when the pinion automatically slides along the screwed end of the shaft until it drives the shaft gear to the propeller. As soon as this begins to revolve faster than the driving pinion, it is thrown out of mesh and the battery current conserved for the next starting operation. This apparatus opens up great possibilities for the future.

Whale Ho!—There She Blows!

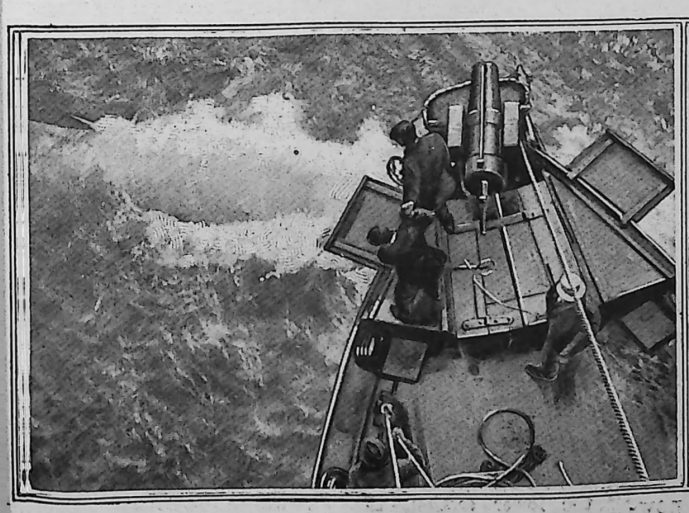
WHALING has been followed for hundreds of years. In the old days of hand harpoons only the sperm, bowhead, and right whales were hunted; but today, with modern equipment, every kind of whale, from the giant blue whale or sulphur bottom to the killer whale, is sought.

The whale yields many products of commercial value—whalebone, oil, fertilizer, and glue. In Japan whale meat has become an important item on the menu of the poorer classes, and it is canned and shipped to all parts of the empire.

Whale-hunting is a dangerous pursuit, and whalers are a rough, hardy lot. They must withstand all kinds of weather in their boats, which are small and round-bottomed to facilitate manipulation and speed.

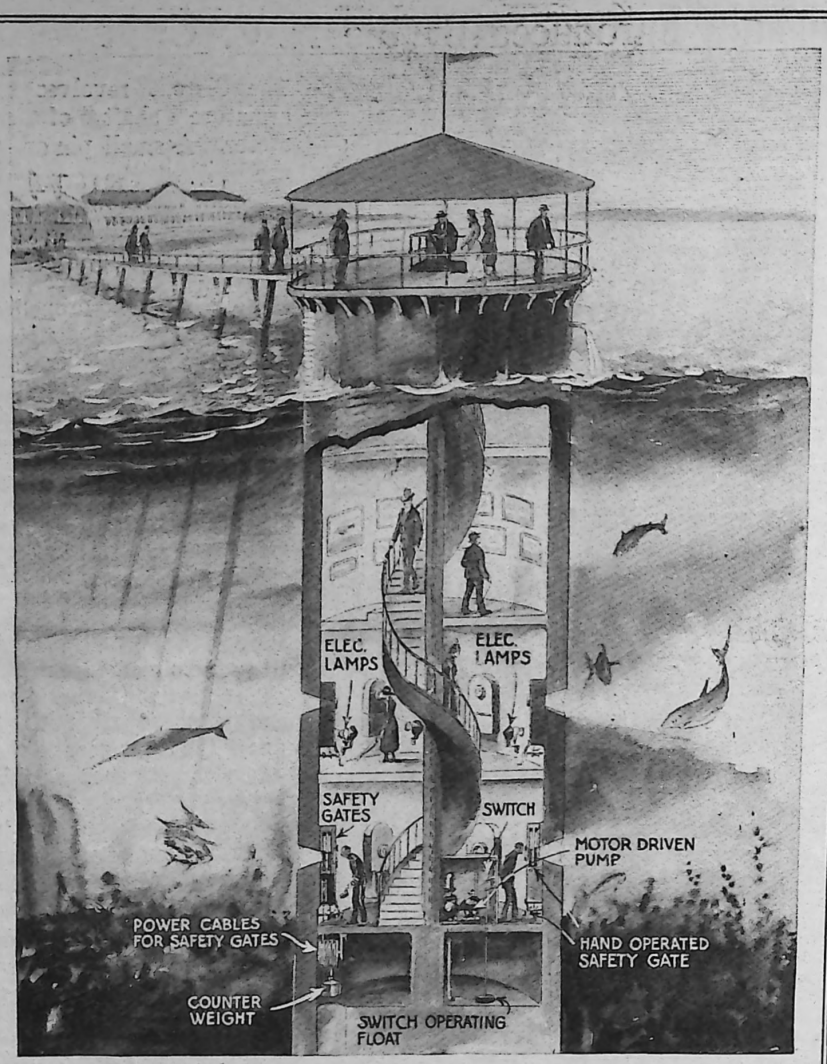
It often happens that a whale, harpooned from the steamer, is not mortally hurt. It is too wild to get in another shot, so a small boat is put out and the game lanced through the heart or lungs with a slender spear. Often the whale will smash the small boat in its death flounderings, if the rowers are not agile enough to dodge its great flukes, so only the most skilful men are allowed to finish a wounded whale.

Whales migrate with the seasons. In the early winter they go south, returning north again in the fall.



The harpoon exploded in the lungs of the whale and it died almost without a struggle and sank. The winch will raise the forty-ton body

Cutting up the head of a dead whale after it has been drawn up on the slip at the shore station. The men work with long-handled knives



For a small consideration, even the poor man may have the pleasure of watching high-priced fish and aristocratic oysters in their natural habitat

Visiting the Fish Without Getting Wet

HOW to observe fish and other sea creatures in their natural environment, without undergoing the dangers and inconveniences of descending in a diving-bell or a diving-suit, has been solved by Edward D. Stodder, of New Rochelle, N. Y.

He proposes to build a pier far enough out over the water so that the wave motion does not disturb the sand on the sea-bottom. At the sea-end of the pier one or more cylindrical structures of steel, cement, or masonry are to be placed. These caissons, which will rest on a firm foundation, are to be high enough to be easily accessible from the platform of the pier through a door in the side of the tower-like caisson.

Around a pillar in the center of the caisson a spiral stairway leads downward below the level of the ocean. Three rows of openings are provided in the submerged part. These openings are funnel-shaped, with the narrow part inside of the caisson and closed by heavy lenses of glass strong enough to resist the pressure of the water. The uppermost and the lowest rows of openings are for observation purposes, the middle row for the purpose of illuminating the parts of the water visible from the observation windows.

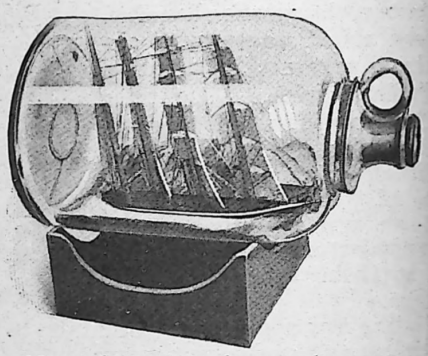
The inventor has provided means for closing the openings in case one or more of the glass lenses should break. The water, rushing through such an opening, automatically starts a mechanism which slides water-tight shutters in front of every one of the openings, and at the same time sets in motion a pump for removing the water which has come in through the broken glass. He has also provided for the closing of all openings by hand power, should the closing mechanism fail to work.

Something to Put in Your Empty Bottle

GOT any empty bottles? Bottle ships in them. Bottled ships are really quite simple. The masts and other parts that project above the hull may be controlled by strings. The hull itself must be made small enough to slip through the neck of the bottle. Then you mount the masts and attach the cords.

When you are sure that all the cords are working properly, slip the flattened ship through the mouth of the bottle, which should contain some moist putty to serve as a bed for the boat to rest on.

Pull up the strings, glue them to the mouth of the bottle, and then cork it.



Mount the masts so they may be managed by cords; when down, slip the whole through the neck of the bottle

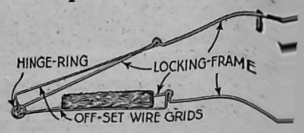
Overcoming Obstacles to Perfect Broiled Hamburger

IF Arthur E. Cowan, of Gloucester, Mass., had never eaten broiled chopped meat, one less patent would have crossed the threshold of the Patent Office. It is a broiler so made that, should it stick to the wires, it will prevent broiled hamburger from crumbling to pieces when you try to lift it.

It is made in two sections, held together at one end by rings; the other ends are free to rotate. The wires are bent at one end. You place your hamburger on one section and close the other down over it.

Should the steak stick to the lower one while cooking, swing the upper one all the way round and the bent wires will gently dislodge the meat, which then slides on to the platter.

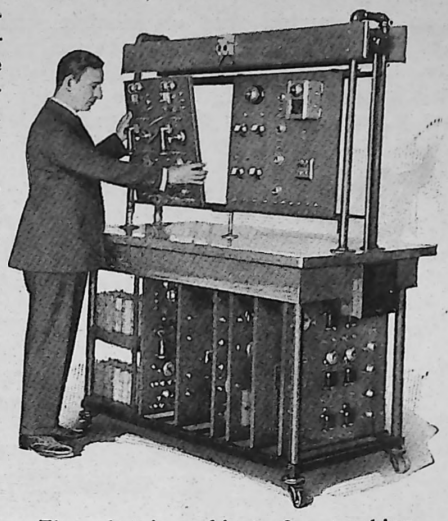
Should the meat stick to the lower section, the upper is swung around beneath it, and its bent wires dislodge the meat



An Electrical Cabinet Designed for the Class-Room

THIS new electric cabinet, containing everything necessary for the study of electricity, looks like a kitchen cabinet. In the first place, there are two shelves that hold nothing but batteries; these batteries are used to supply the current for experiments. Since the voltage is low, danger of shocks and accidents is eliminated.

Then there are several boards that slide into grooves in the cabinet. These are fitted up with various electrical instruments, such as bells, telephones, meters, and push-buttons. The boards may be taken out of their racks and hung up in front of the class, and the pupils can practise on them.



The electric cabinet for teaching electricity contains many boards on which there are several electrical instruments; the pupils wire them up

Fireproofing the Air Mail

YOU want to rush an important document to Washington by air mail, but you are afraid to. Suppose the airplane should catch fire? Your document would be burned, you think.

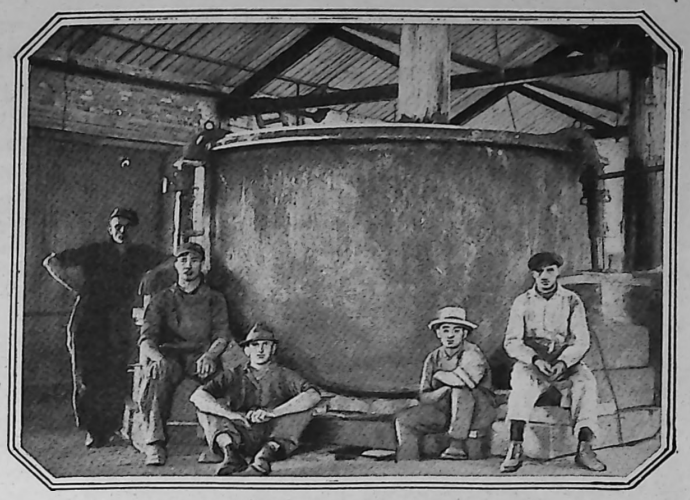
But you are wrong. Air mail is wrapped in an asbestos cloth container that is fastened to the airplane by thin steel strips and screws. Ten yards of asbestos cloth and ten yards of khaki cloth are used in the container. The asbestos cloth weighs two and one quarter pounds to a square yard.

The Post Office Department tested one of these new fireproof bags at College Park, Md. A sack of dummy mail was enclosed in the bag, and the bag was soaked in gasoline. It was then set on fire and allowed to blaze for twenty minutes.

When the blaze was put out, at the end of that time, it was found that nearly all the letters were intact—the few on the outside being slightly charred.

© Harris & Ewing

Air mail is now enclosed in bags made of asbestos cloth; even should the airplane catch fire, the mail will be safe

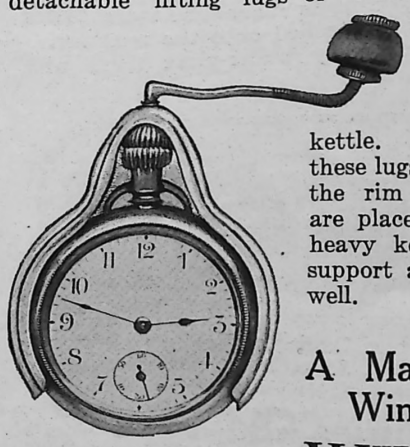


A big caldron raised from the heating well by means of jacks placed under the lifting lugs attached to the rim

Lifting a Heavy Caldron Without the Help of a Crane

IN the manufacture of caustic—which, in the language of chemistry, may be either sodium or potassium hydroxide—large caldrons of cast iron are used. Many of these caldrons have a diameter of ten feet, a depth of seven feet, and weigh about fifteen tons. Each one of these enormous kettles is placed in a well of fireproof brick and its bottom rests on ball-bearings supported by a pedestal of concrete, centrally placed in the bottom of the well. In the sides of the well are openings communicating with the furnace. The kettle is rotated to prevent uneven heating.

Occasionally it becomes necessary to lift the caldron out of the well. A crane sufficiently strong would cost a great deal. Frank G. Wheeler, of Appleton, Wis., uses detachable lifting lugs of C shape, which fit around the rim of the caldron and have a bracket at one end which engages the under side of the raised flange of the kettle. After three or more of these lugs have been clamped to the rim of the caldron, jacks are placed under them and the heavy kettle is lifted from its support and out of the heating well.



This mechanical watch-winder saves many sore fingers in a large repair shop

A Machine Even for Winding Watches

WHEN you wind your watch up at night, you do not feel that you have performed a very strenuous operation; neither have you. But multiply the operation by twenty, a hundred, two hundred, and you begin to have visions of aching fingers and sore thumbs. This is exactly the way the watch repairer finds it.

To save both time and fingers, an ingenious watchmaker invented the winder, a photograph of which is reproduced above. It is merely a metal clip to hold the watch and a clutch that engages the winding key. Insert the watch in the clip, hold it tightly, turn the handle a few times, and the watch is wound.

Many a repairer has several hundred watches on his racks at a time, and some such device as this is a great convenience and time-saver.

As the cylindrical tank is rotated, molten iron pours from nozzles into molds; two men handle it easily

Making It Easy to Handle Molten Metal

LADLING molten iron by bucket requires plenty of help and much care. A Cleveland foundryman has invented an efficient ladling-machine that can be worked by two men.

A cylindrical tank mounted on wheels that run in tracks is filled with molten iron. One man moves the tank until it is directly over troughs that lead to the molds. Then the other man turns a handle and the tank revolves. Two nozzles discharge the iron into the troughs every time the cylinder is rotated. The tank is then rolled onto the next set.

The tank is made of heavy boiler-plate lined with fire-brick.

These five pieces of type, bearing strange Oriental characters, were used in Korea in the year 1403

Five Centuries Old Type

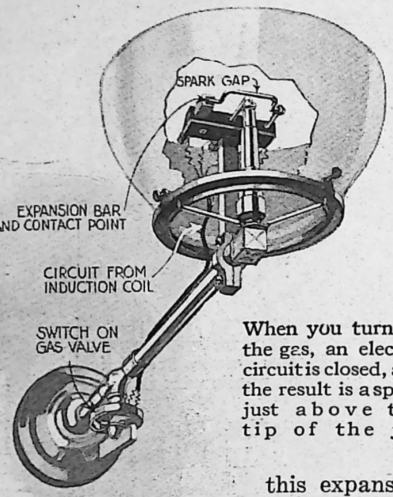
BACK in the beginning of the fifteenth century, the Korean printer sat cross-legged in front of a "form" and "pulled proofs." And even in that far-off day he used metal type not so very different from the type used now. The strange Oriental characters stood out from the upper surface of each piece of type, and the lower surface was curved so that it would cling firmly to the bed of beeswax into which it was sunk. The printer inked the type, laid the paper on it, and gently brushed the paper with a piece of felt. Thus he pulled proofs at the rate of fifteen hundred a day.

Fifty pieces of this type are now in the American Museum of Natural History, New York, and fifty more are in a museum in England.

Turn on the Gas Like Electricity

YOU light a match, turn on the gas—and the match goes out. Then you turn off the gas, look for another match, and start all over again. Ah, but there is an automatic gas-lighter, invented by Edward Obermeyer of Nessen City, Mich.

It is so constructed that an electric spark jumps across the tip of the gas-jet every time the gas is turned on. Furthermore, if the gas should be blown out accidentally the spark will reappear and ignite the escaping gas. The gas-cock has a bar within it that is part of an electric circuit. When the valve is closed the bar does not touch a contact point near it and the circuit is broken. But when the cock is turned and the valve opened the two contact points touch each other and the circuit closes. A current is induced into a second circuit, whose contact points are spaced a short distance apart directly above the tip of the jet. This current is strong enough to cause a spark to jump across the gap and light the gas.



When you turn on the gas, an electric circuit is closed, and the result is a spark just above the tip of the jet

Once the gas is lit, the heat from the flame will expand the arm that furnishes one of the contact points of the spark, and this expansion breaks the primary circuit and does away with the spark.

In Case of Emergency Use the Wayside Telephone

YOU start to skid, lose control of your car, and crash head-on into another car! You are miles from the nearest town—what's to be done? In a case like this a "wayside telephone" is a godsend. All you need is a key to the telephone box. These boxes are painted red and white and are located a mile apart on the road along the Mohawk river in New York State. In case of accident of any kind, you walk to the nearest one, and open it. Inside you will find a telephone and a list of the nearest doctors, garages, hospitals, and hotels, with their telephone numbers.

The car hit a fence, and the driver was hurt. The nearest town was some distance away, but a "wayside telephone" was handy and one of the men unlocked it. Besides the telephone, there is an emergency directory, containing the names of the nearest doctors, garages, and hotels, with their telephone numbers

Why Small Models Won't Work When Enlarged

The Patent Office abandoned them long ago

By C. A. Briggs

MANY years ago the Patent Office abandoned the practice of requiring working models when issuing patents. This was done in the face of increasing complexities in the devices presented for patenting. Now patents are issued on the basis of drawings and descriptions, except in special cases.

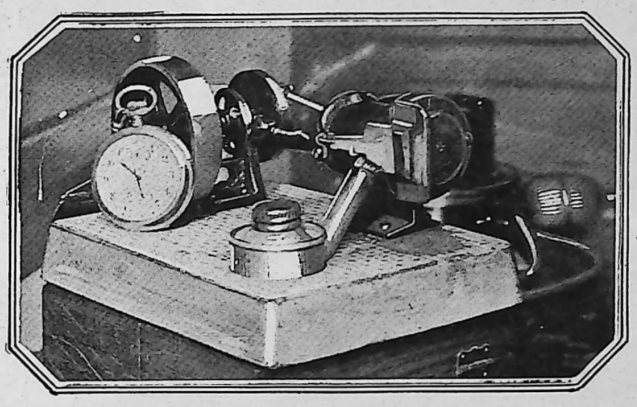
It was found that models were often more misleading than instructive. The full-sized model may prove impractical even when the small one seems to work perfectly; and the reverse may be true—a large design may give results to an extent that was not indicated at all in the small model.

Probably no better device for illustrating the achievements and perfection of modern design could be found than the typewriter of the present day; yet the same arrangement when made on a large scale will serve to illustrate just what a design should not be. A fourteen-ton typewriter was built for the San Francisco Exposition by a typewriter company. When this large typewriter was operated, the arm carrying the type on the end moved ponderously up and struck with a *pung*. It then fell back with a *clank*, and bounced two or three times before coming to rest. These arms were so heavy that a special engine had to be installed in the foundation below the typewriter to operate the parts.

The spring that caused the carriage to move was a relatively weak one. If this spring had been made to scale, its use would soon have wrecked the machine. On the ordinary sized typewriter of this design a speed of one hundred and seventy words a minute has been obtained by the best experts. The huge model was capable of about thirty letters a minute.

There are certain relations between the strength, weight, inertia, size, time of action, and deflection that dominate design; and good design is always consistent in this respect.

Some time ago the writer was shown a toy engine. The parts comprised a flywheel, a crank, a piston, a cylinder with an opening at one side near the closed end, and a valve consisting of a piece of thin sheet-iron that could be moved back and forth across the opening by means of a rod engaging a cam mounted on the axis of the flywheel. Just in front of the valve opening there was a tin lamp with a wick for burning alcohol.



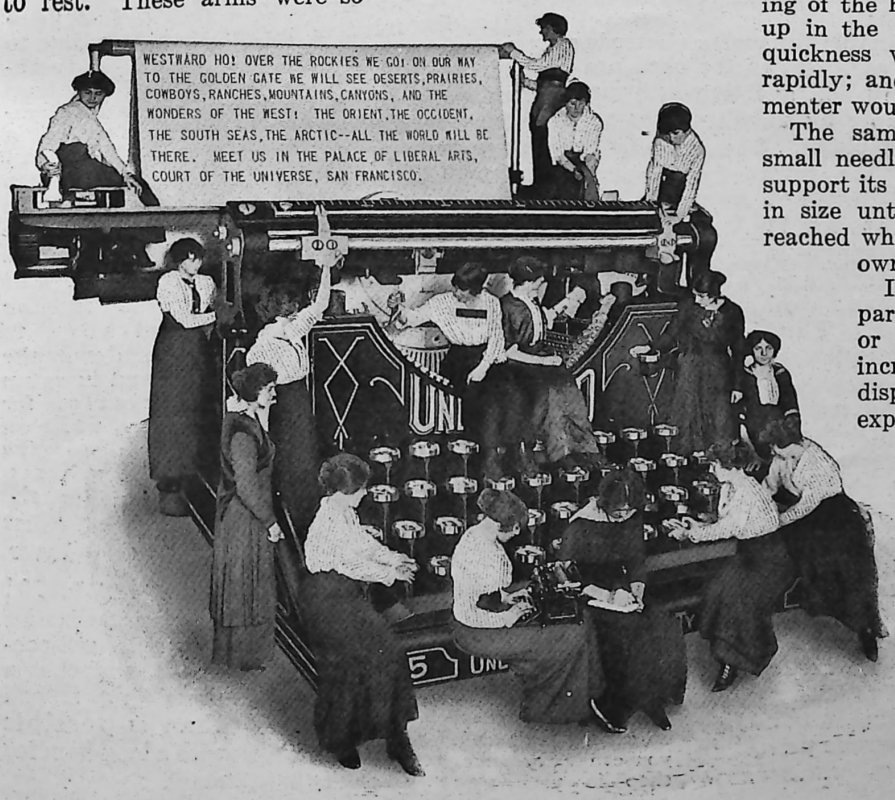
This tiny engine is a speed demon; the piston is shot backward and forward by the rapid heating and cooling of the cylinder—the heat being produced by an alcohol flame and the cooling by the shutting of an automatic valve. But would this hold good for a large engine? That is a question

When the engine was started the piston moved away from the opening and thus sucked in the hot alcohol flame. Just before the end of the stroke was reached the valve would close the opening, and the cooling of the hot gases would then create a partial vacuum. The result was that the piston was jerked back. The power and speed of this little engine was surprising. When going well it would simply roar. The behavior of the engine was so striking that it occurred to almost everybody, on seeing it run, that it would be desirable to make a large engine on the same principle.

However, one thing on which the action of the engine depended was the very rapid cooling of the hot vapors and gases when they were shut up in the cylinder. Now, as the size increases, the quickness with which the gas cools falls off very rapidly; and if a large design were made the experimenter would find his attempt a failure.

The same thing applies to electrical devices. A small needle can easily be magnetized so that it will support its own weight. When the needle is increased in size until it becomes a bar, the point is soon reached where the bar will not be able to support its own weight.

In electrical machinery the heating of the parts is often the limiting factor in the capacity or use of a device. The heating tends to increase with the volume, and the ability to dispose of this heat increases as the surface is exposed. The volume increases as the cube of the dimensions, and the surface as the square of the dimensions. It is therefore necessary in the larger sizes of machines to alter the design to provide, among other things, the necessary arrangement for getting rid of the heat.



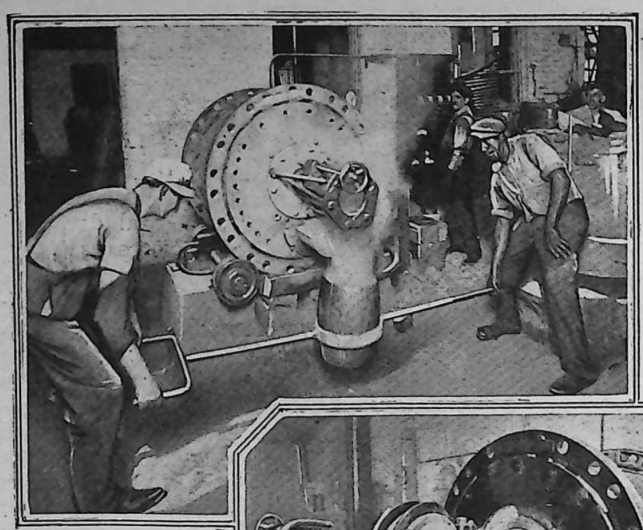
This fourteen-ton typewriter is an exact enlargement of one of the present well known machines. Its operation is difficult and slow. Small models often fail to work after they have been enlarged

A Grip for the Rivet

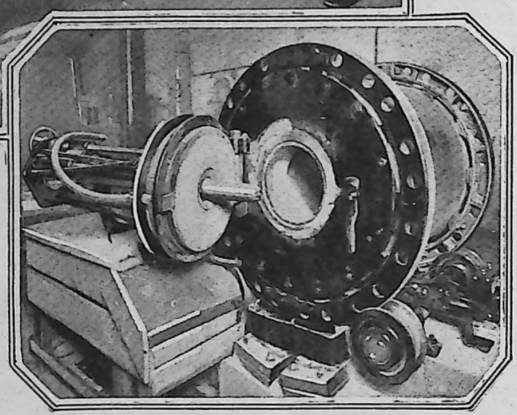
RAT-TAT-TAT! The sound of riveting drowns everything else; and the riveter must listen to it all day long while he tightly grasps the vibrating hammer. A hard life, to be sure.

But a grip has been invented that will make his work much easier. It fits over the business end of the hammer and provides a sure grip. The riveter simply grasps a projecting handle in order to guide the hammer to the work.

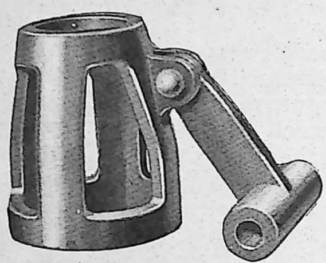
The grip is made of steel and can be used on chipping or calking hammers. It adapts itself to either right- or left-hand riveting, and is particularly helpful for overhead riveting.



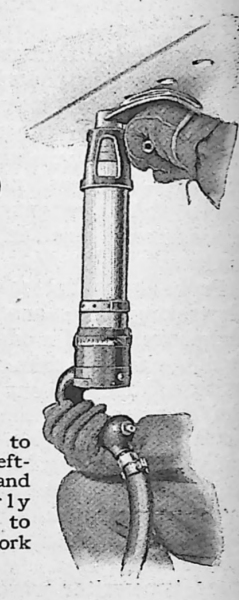
The molten brass is being poured from the electric furnace; the man at the switchboard controls the flow



This is an electric furnace; the electrode that heats the metals is seen protruding from inside of the door



A grip has been invented that fits over the muzzle end of a riveting hammer and has a projecting handle that the riveter grasps; his work is thus made much easier



It adapts itself to either right- or left-hand riveting and is particularly adaptable to overhead work

Making Brass in an Electric Furnace

A NEW electric furnace for melting copper and zinc to make brass has recently appeared. Hitherto it has been possible to melt these metals and alloys only in crucibles.

The electric furnace is rotated by rollers and moves in two cylindrical tracks. The rollers are driven by a motor at the proper speed to make the furnace rotate at the rate of two revolutions a minute. The electrodes for melting the metal are heated by a current that comes through short pieces of flexible cable that connect with the track; and the current is supplied to the track by means of shoes which press against it.

On small furnaces electrodes are operated by hand, but on the larger furnaces automatic electrode control is used. In the small furnaces the door is in one end only, but in the larger furnaces both ends are provided with doors. In the lower of the two pictures above you can see the latch that holds the door shut when the furnace is charged, and also the electrode projecting through the door. The contact shoes are shown pressing against the track.

The cable that supplies the power to the furnace comes from conduits in the floor. The operator regulates the flow of the current by means of a handwheel. The upper picture shows the metal being poured from the furnace. The operator at the switchboard is controlling the furnace by means of push-buttons. The two men in front are holding the bucket.

Probably the most important of all factors in reliable and efficient furnace operation is the furnace lining. Especially is this true with the melting of non-ferrous metals, where a lining with many joints will have a decided tendency to absorb metal. In order to overcome this difficulty the lining should have as few joints as possible.

In this furnace the electrode supports at each end of the shell are made in one piece, and they may be removed simply by unbolting them from the end plates. The shell can be lifted off the rollers by a suitable hoist or crane, just as if it were a barrel, and turned on end. Thus the end plate of the furnace can be unbolted and removed from the shell.

The door of the furnace is made of one solid piece of brick, with a hole in the center through which the electrode projects.

A New Reason for a Clean Face

DID you ever have to start on business to a distant city on a few minutes' notice, with just time to buy your railroad ticket, a toothbrush, and a clean collar? Perhaps that is what was in Charles E. Gronbeck's mind when he invented a vest-pocket edition of the safety razor.

The new razor consists simply of a light frame to take the blade. The lower edge of the frame is provided with the familiar serrated edge to smooth down the cheek and bring up the bristles for slaughter, while an extension of the frame provides a firm grip for the thumb and first finger of the shaver. The inventor points out that his device is self-contained, and that a closer grip is had than is possible with a long-handled razor.

© Press Illustrating Service

So small is this safety-razor that you can carry your own barber-shop in your vest pocket

Around the World in a Minute

YOU can cross the Atlantic ocean in three seconds! Leap over a volcano in one bound! Race from the North to the South Pole in half a minute! That is, if you visit the miniature Earth built in Boy Land, Santa Barbara, Cal. The Earth is laid out flat, map fashion, and covers about two acres of ground. The continents, rivers, lakes, and oceans are exact small reproductions of those on the Earth. Every wrinkle, mountain, and valley is in perfect proportion. The waters of the Earth are there, too—the Atlantic being about three feet deep.

Boy Land is a school founded by Prince Hopkins; the building of the Earth is his way of teaching geography to his pupils. Mr. Hopkins, who is going to start another Boy Land school at Stamford, Conn., tells us the following:

"When I started my school in Santa Barbara I had a dike built across a little valley. I then said to the boys: 'The pool of water formed by this little dike will represent the Atlantic ocean. We will take a Mercator's map of the world to show us how we should dig the shore lines to make them resemble the shores of America and of Europe. Then we can build boats to sail across, like big steamers that cross the ocean.' We took a map down, and drove stakes into the ground from which to stretch strings from north to south or from east and west, to represent lines of latitude and longitude.

"Next we marked the contours of shore lines by means of a tennis-court marker, and we dug earth from the ocean and lakes to pile up into the mountain ridges. To make this physical labor more exciting, I had a little dredger boat made for them. On its arrival, the boys inspected this boat with great interest. We floated it in the ocean above the dike. A gasoline engine inside, which one boy could operate, ran a little chain of buckets.

"The mechanical efficiency of this machine was low, but its psychological efficiency was high, since digging became much more interesting when carried on to the music of the little dredger chug-chugging near by.

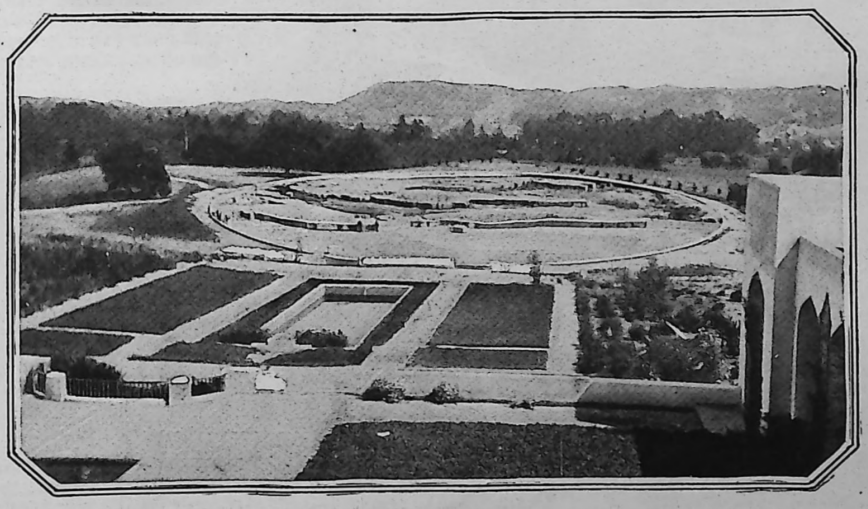
"This dredger engine-boat demanded great attention at the time of the opening of the canals, the boys themselves putting in the Suez and Panama canals.

"A railroad system will connect the series of small cottages at one end of Boy Land with the main cottage at the other end. It will be used not merely as a toy, but as a valuable means of transportation. Things obtainable at the larger building, such as linen for beds and baths, will be taken over on the train, and likewise vegetables, wood, etc., will be taken to the main building.

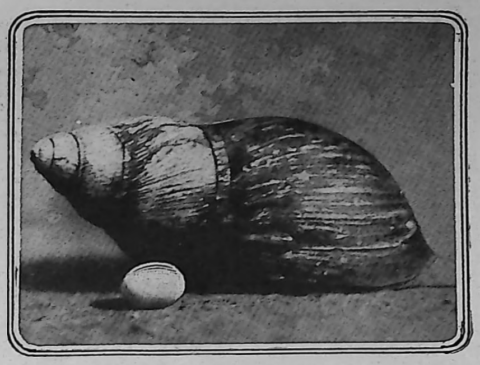
"At Boy Land we sometimes take our history books out on the huge open-air map of the world and there dramatize various events at what corresponds to the very spot where the real life-drama was originally enacted. The main purpose of the map is, of course, to visualize geography. It's large enough so that the boy himself can paddle through the world's chief waterways; and the railroad lines of the various nations are presented in miniature. The boys have, of course, built the ranges of mountains in relief, and have here and there represented agricultural products of the different countries.

"While the map was still in construction a lively commerce sprang up. Little ships traveled along the main waterways, and we began to lay the main trunk railways of the world with toy railroad tracks."

The Pacific Coast is getting its final touches; next the ocean will be poured in



Behold the Earth! It is reduced to two acres and is laid out flat, but the waters and continents are all in proportion



The snail is eight inches long, and came originally from East Africa

A Giant Snail and Her Egg Side by Side

ONE of London's foremost Zoos is very much excited—it has added to its collection some giants. They are snails, and many of them measure as much as eight inches. If you picked one up it would just about fit in your hand.

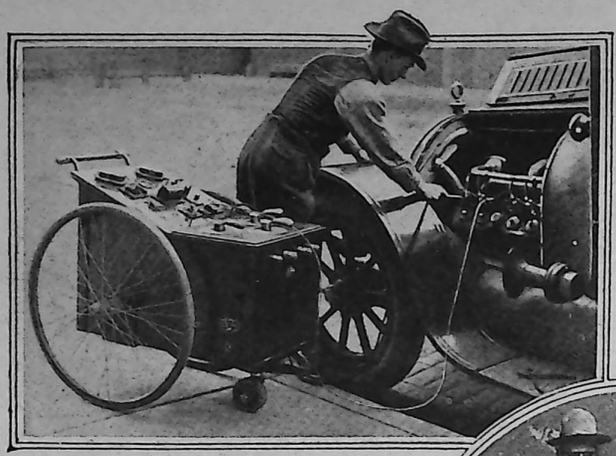
These snails came from East Africa; had they remained there much longer they probably would have been eaten by the natives. Both the snail and its egg are considered delicacies in that far-off land.

The egg of this snail is so large that it is often mistaken for a pigeon's egg. A picture of a mother snail and her egg side by side is shown in the picture above.

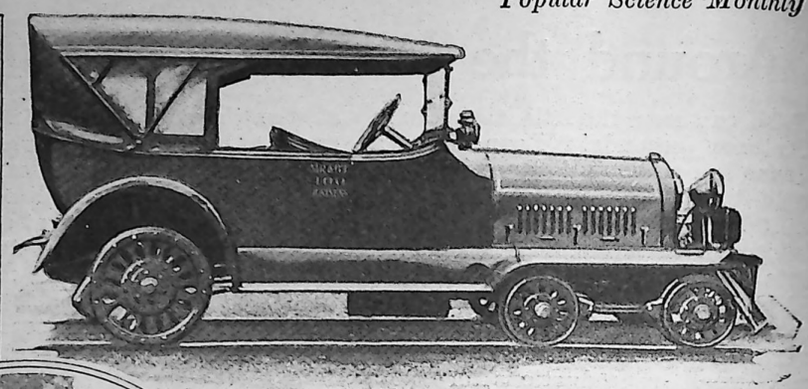
Cultivating Cooties for Scientific Reasons

AN incubator for cooties! Service men might think this superfluous trouble, when so many of the cooties could be freely obtained from the foreign camps during the war. But to study the pest scientifically an incubator for rearing them was required, the investigators devising an arrangement for bringing up great numbers of the lice. The cooties had to be fed, and human blood is their food, so volunteers sacrificed themselves for the cause. As many as four thousand were fed at one time on the forearm of one person.

Since it has been found that the germs of several diseases are carried by the cootie, Serbia typhus fever being one of them, the need of incubator methods for enabling scientific study to eradicate the evil is apparent.



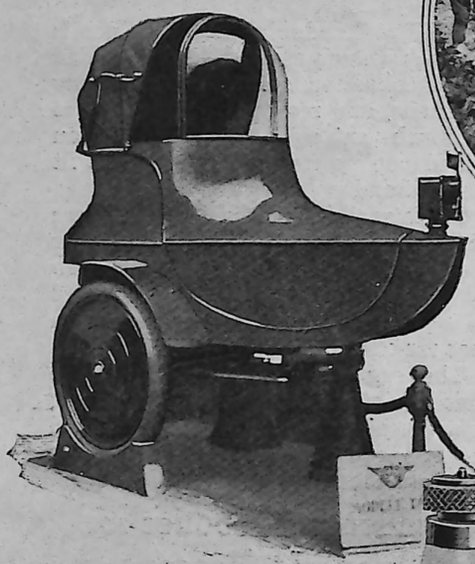
The electrical test-cart is the first thing of its kind in the way of a complete apparatus for testing any part of the electrical mechanism of automobiles, trucks, and tractors



When the government laid up all private cars, a railroad president wanted something to take him over the company's road. His automobile makes sixty miles an hour upon the rails

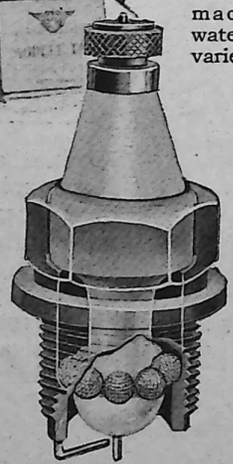
Things New in the

Here are a few suggestions comfort: choose the ones



One of the most curious exhibits shown in the recent Paris automobile show was a side-car for use on a motorcycle and serving as a side-car taxi-cab

Operated in small spaces this baby tractor was adopted by the government for work in camp gardens. It plows or cultivates, runs a washing machine, pumps water, in fact does a variety of odd jobs

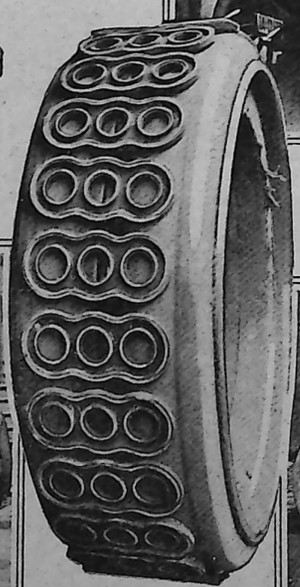


The rough-surfaced balls move up and down by piston pressure, keeping the spark-plug clean

© International Film Service Co.

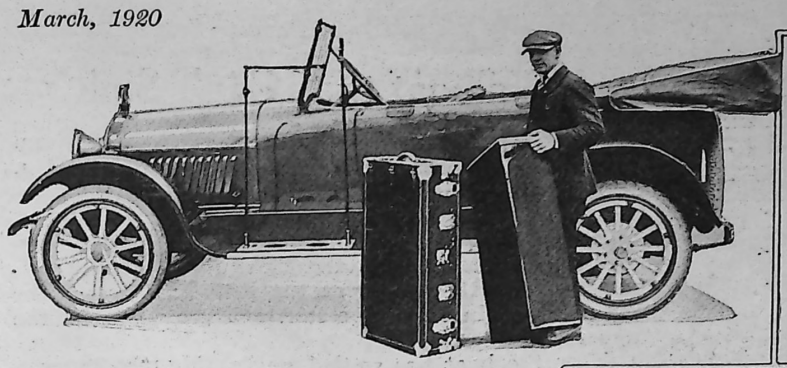
"A whale of an automobile," you say. You're right, too. A manufacturer took this means to advertise a certain product. Jonah peers from between the whale's jaws

Here is a truck body made from gas-piping. The rear doors are also of pipes, which slide into each other when opened. The novelty of the scheme should appeal to truck-owners



These metal pads encircle the tires and prevent slipping without the usual unpleasant bumping. The holes in the pads increase the traction

Covered with racing laurels, this aged car came from France to hang up new records for the year 1920. Incidentally it made a fine showing here last year

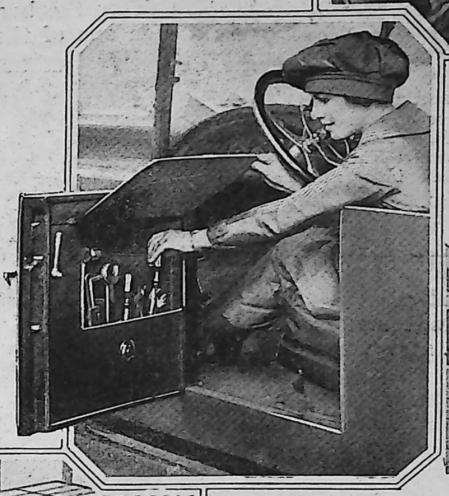


The slidable trunk-holder includes springs which support the trunk so that its contents are not shaken even when the car travels over rough roads

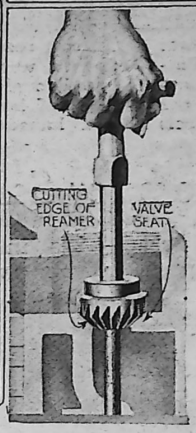
If the windows in your rain curtains tear or break, you can easily purchase others and apply them in a few minutes in the manner shown here

World of Motors

for your convenience and best suited to your needs

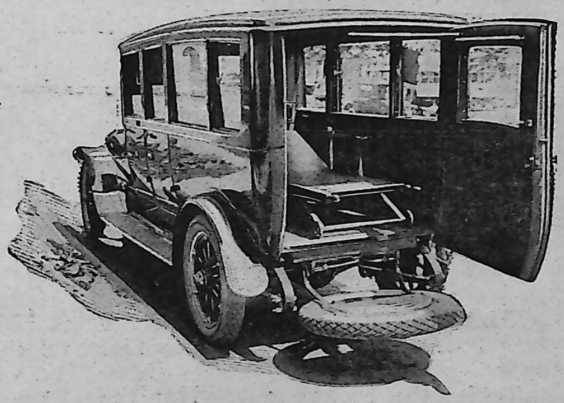


Instead of a tool-box on the running-board, the 1920 car has a tool compartment in one of the front doors. The flap of the compartment can be locked



With this simple tool, made of the best cutting steel with a self-centering projection below the cutting edge of the reamer, valve seats may be ground easily, quickly, and cheaply

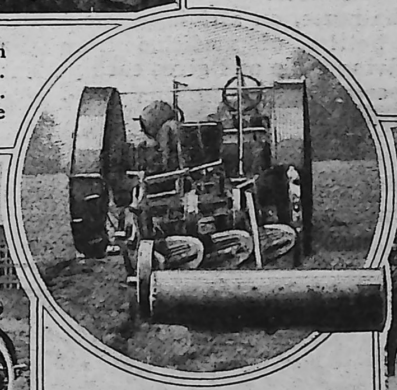
An electric crane swings a ladle before the mouth of the furnace and the clay stopper is removed. The bucket of molten metal is carried to the molds. Thus the automobile cylinder block is made



Easily transformable into either an ambulance or a limousine, this novel automobile serves a twofold purpose for its renting owner

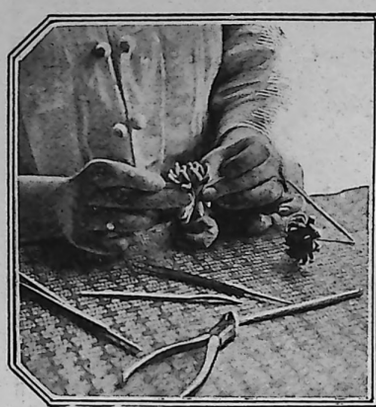
© International Film Service Co.

With a suitcase strapped on behind the little red wagon, a week-end can be pleasantly spent, especially if the owner is within a few hours of duck country



A heavy roller, having a long arm by which it is attached to the plow frame drawn by a tractor, utilizes a roller much heavier than the ordinary one. The rolling and plowing can now be accomplished in one operation

Prohibition has not yet reached Bombay, India; nevertheless a wine-cask serves as a water container for street sprinkling. The cask is mounted upon a motor-truck. Formerly ox-carts were used



Here is a bread-dough flower in the making; Madame Gatticker does most of the shaping with her hands, but she also uses pincers and scalpels

These realistic artificial flowers were made from bread dough, taken from the heart of hot fresh bread and kneaded into shape

Bread Flowers for Sale Here

DON'T eat fresh hot bread — it's indigestible. If you doubt this, take a piece in your hand and squeeze it. When you open your hand you will have a soggy, heavy lump of dough in it. Madame Prosper Gatticker, of Paris, did this once, and she kept right on squeezing and shaping it until she had in her hand a perfect imitation of a rose. She hardened it in front of the fire and painted it red. And so she began making artificial flowers out of bread dough. She sold them, and turned the money over to the poor.

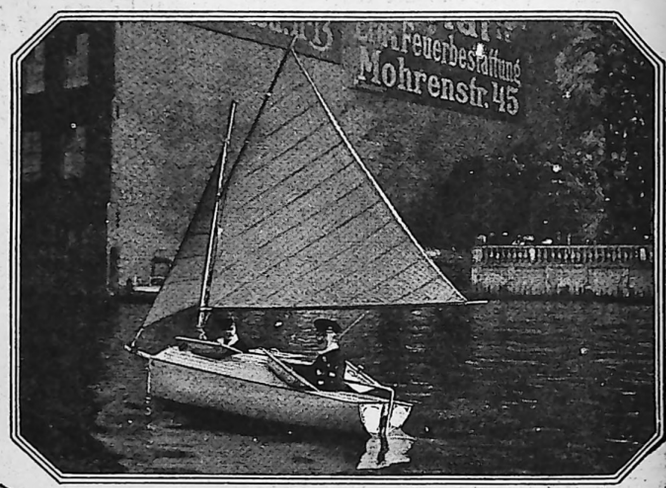
You see, Madame Gatticker is one of the idle rich, and she does this work partly to fill up the time and also to interest her friends in philanthropic work. During the war she sent packages to many lonely soldiers, and was known as *La Marraine Mysterieuse*—the mysterious godmother.

A Sailboat that Can't Sink

BELOW you see a German inventor in his aluminum boat. Aluminum is light enough to make a fast sailing-craft, but this very lightness tends to cause the boat to capsize.

In that case, what happens to the passengers? They are perfectly safe: the hatches close automatically over the heads of the people as the boat goes over. The water forces the lower two shut and gravity drops the upper ones.

After the boat has settled on its side, the inmates open one of the upper hatches and shout for help.



Photographs © Ledger Photo Service

This non-sinkable sailboat made of aluminum was built in Germany

Of course an aluminum boat capsizes easily; but the hatches close automatically as the boat goes over, and after it settles the people within open one of the upper hatches and call for help

This Clock Calls Nurse and Medicine

CLANG! The clock strikes one. A little door above the face flies open.

To let the cookoo out? No; the medicine bottle. You see, the clock is part of a medicine chest for use in hospitals.

The striking of the clock summons the nurse, and when she arrives she finds before her the open door. Inside it there is a small revolving table on which are placed the different medicines that she is to give to her patients at that hour.

Within the chest there are several small revolving tables, one for every hour of the day. Each table is marked with its particular hour. Every morning the nurse puts on the one-o'clock table the medicines that should be given to her patients at one o'clock. She does the same thing for every other hour in the day, and then goes away and forgets all about the bottles until she is summoned by the striking of the watchful clock.

The clock goes round, and as each hour strikes, its corresponding table moves into place in front of the medicine-chest door.

The nurse, on arriving, simply lifts the bottles of medicine from the revolving table and gives each patient his particular dose.

When the clock strikes, a door flies open and a bottle of medicine stands behind it on a revolving table; there is a table for each hour of the day

A Train Helps Out an Airplane

PILOT P. W. Smith was ready to hop off on his daily letter-carrying trip to Chicago, and he went to the shed to get some water for his engine. Alas, he found there was none; the pipes had frozen overnight.

As he stood pondering, the toot of a train whistle sounded in the distance, and in a few minutes a train passed within a hundred feet of the hangar. As it approached the pilot flagged it and told the engineer his troubles.

"Glad to help you out," said the obliging engineer of the train.

The passengers, accustomed to delays, didn't mind this one. Two fifty-gallon tanks, which had held gasoline, were rolled up the railroad embankment and filled with hot water fresh from the boiler.

In a very short time the airplane had started, and the letters it carried arrived on time.

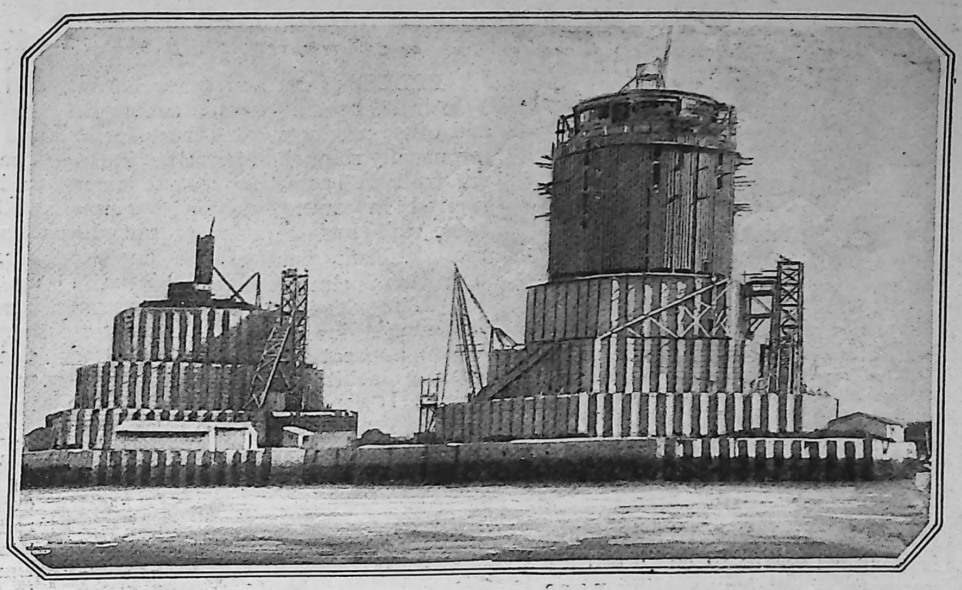
Cleaning Out the Hornets' Nest

WHEN hornets build their nest outside your window, clean them out with a vacuum cleaner, says Mr. A. E. Gardner, of Philadelphia.

"I attached a piece of piping to my vacuum cleaner," says he, "and held the end up under the opening of the hornets' nest; then I turned on the power. Hundreds of hornets poured forth and were promptly sucked down the pipe.

"Later I carefully opened the bag of the cleaner, fearful lest there were some still alive. But they were all dead."

Don't argue with a hornet or you'll be stung. If you wish to empty a hornets' nest get out your vacuum cleaner and simply suck the hornets into the bag



Concrete towers go out after a sunken ship and, with the aid of the tide, are able to drag it inshore; where the tide is not great enough the towers are filled with water and sunk to the depth of the ship

Raising Sunken Ships with Hollow Towers

"A SECOND tower of Babel!" murmured the wondering townsfolk of Southwick, on the coast of England, as they watched the erection of a curious tower-like structure on the beach. The tower was hexagonal in shape. There were four stories, each one sixteen feet high, and the stories receded gradually. On top of all was a great tower. When it was half finished another one was started.

The towers turned out to be great salvage ships, built by the English government for use in raising vessels that were torpedoed in the war. They are so constructed that they can dig up ships that have sunk in water deeper than twenty fathoms.

Each story is made up of hollow concrete boxes four feet square and two feet wide. They are fastened together by steel cables. Thus the whole structure is very strong, and yet light enough to float in fifteen feet of water. Now for the action!

Two of these floating towers are sent out to salvage a ship. Suppose the ship is in fairly shallow water. The towers are towed out and stationed one on each side of the wreck. Divers pass steel hawsers from the towers under the wreck, and make sure that it is held fast.

When the tide is lowest, the hawsers are tightened. As the tide rises, the buoyancy of the towers raises the wreck from the bottom. The whole outfit is then towed inland until the wreck hits bottom. At low tide the hawsers are tightened, and the process is repeated until the wreck is near enough to shore to be patched.

In places where there is not enough tide, water is pumped into the towers and they sink. When the wreck is properly roped, the water is pumped out again. And as the towers rise they take the wreck with them. Old hulks have often been used for this kind of salvage work, but this is the first time that concrete ships have been specially built primarily for the purpose of salvaging.

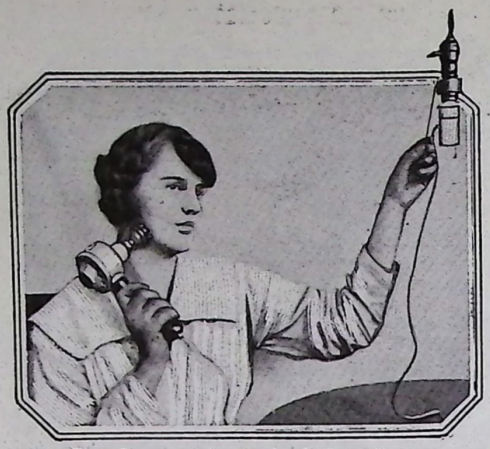
Tanks in the Sight-Seeing Business

MOUNTAIN climbing is hard work for most people, but easy work for tanks; consequently, many of the French war tanks that are now idle are being made over into sight-seeing buses for use on Alpine mountain roads.

At the right you see a Peugeot tank that has been made over to accommodate ten passengers. While the tank slowly crawls along, the people sitting on top of it can give all their attention to the wonderful scenery about them.

A tank, as you know, can successfully climb over almost any obstacle, and will move calmly onward from a most perilous angle.

War tanks are being turned into sight-seeing buses in France; this one will accommodate ten people, and makes regular trips up the mountain roads in the French Alps



The force and speed of the vibrator can easily be changed by a device that gives twelve gradations of power

How to Cut Down Your Electric Light Bills

EVERY user of electric light has it in his power to cut down his electric light bills by avoiding waste as much as possible. The most radical way of practising economy in the use of light consists in turning off the current when the light is not needed. But often, while the full intensity of the light is not required, there must be some light. For several years there have been in the market electric lamp sockets that make it possible to obtain from two to five gradations of light by setting a switch increasing or diminishing the resistance of the rheostat in the socket.

Recently a new light-regulating socket has been invented with which twelve gradations of light may be obtained by the mere pulling of chains operating the switch of the rheostat. The gradations range from the full light obtainable from a forty-watt lamp to a faint glow of the filament when the current is reduced to five watts.

The Drum that Wears a Wound Stripe

THEY were gathering in the wounded after one of the battles at Verdun, when they came across a drum that had been shot through the head. It was taken to the hospital and given a new one. In a short time it was back at the front, in active service again.

Now that the war is over, the drum has been ordered back to the Marine Corps camp at Quantico, Va. The regiment decided to present it with wound and service stripes—but a drum has no sleeves to wear them on. So the four service stripes were attached to one side of its head, and one wound stripe was placed on the other side.

Shot through the head at Verdun, this drum now wears a wound stripe, together with four service stripes; someone has also presented it with a Croix de Guerre

Packing the Farmer's Fruit

APPLES, pears, and other hardy fruit, beets, carrots, cabbages, and other products of the truck-farm, are usually shipped in barrels. Packing fruit in barrels so that it is not injured in transportation requires some skill and experience, but the most difficult part of the packing operation is closing the packed barrel by placing its head in position and fastening it down.

An apparatus recently patented greatly facilitates this closing operation. It consists of a base shaped to receive the bottom of the barrel, two tiltable posts which support the framework of the closing mechanism, and the lever arrangement by which the head of the barrel is forced down and into the groove provided for it. The barrel to be headed is placed in its proper position on the base, while the posts are in a tilted position, facilitating the placing of the barrel in position. Then the posts are brought to a vertical position, the barrel head is placed on top of the barrel underneath the disk of the closing mechanism, and the lever is pressed down, forcing the barrel head into its groove.

The disk pressing against the barrel head is held in a horizontal position by a cross-frame guided in its up-and-down movements by tubular guide-rods which slide within the two tubular posts supporting the closing mechanism.

After the barrel has been placed in position on the base of the machine, the downward motion of a lever will press the head of the barrel home into its groove

By raising the seat, the teacher can sit in her pupil's place; the pedestal takes up little room

Advocating Pedestals for Students

EVEN if you don't put your child on a pedestal, his school-teacher probably will—for the new pedestal school-room seat is becoming increasingly popular. One child's seat and the desk of the child behind him are mounted on a pedestal, so that either one or both of them may be easily removed.

The pedestal takes up much less room than the usual spreading leg support with its complicated framework. The height of both desk and seat on the pedestal can be adjusted to suit the pupil, and the seat is mounted swivel fashion, so that he may swing it slightly from side to side.

Jumping the Dams with Your Ship

A boat-lifting mechanism that would open waterways now closed

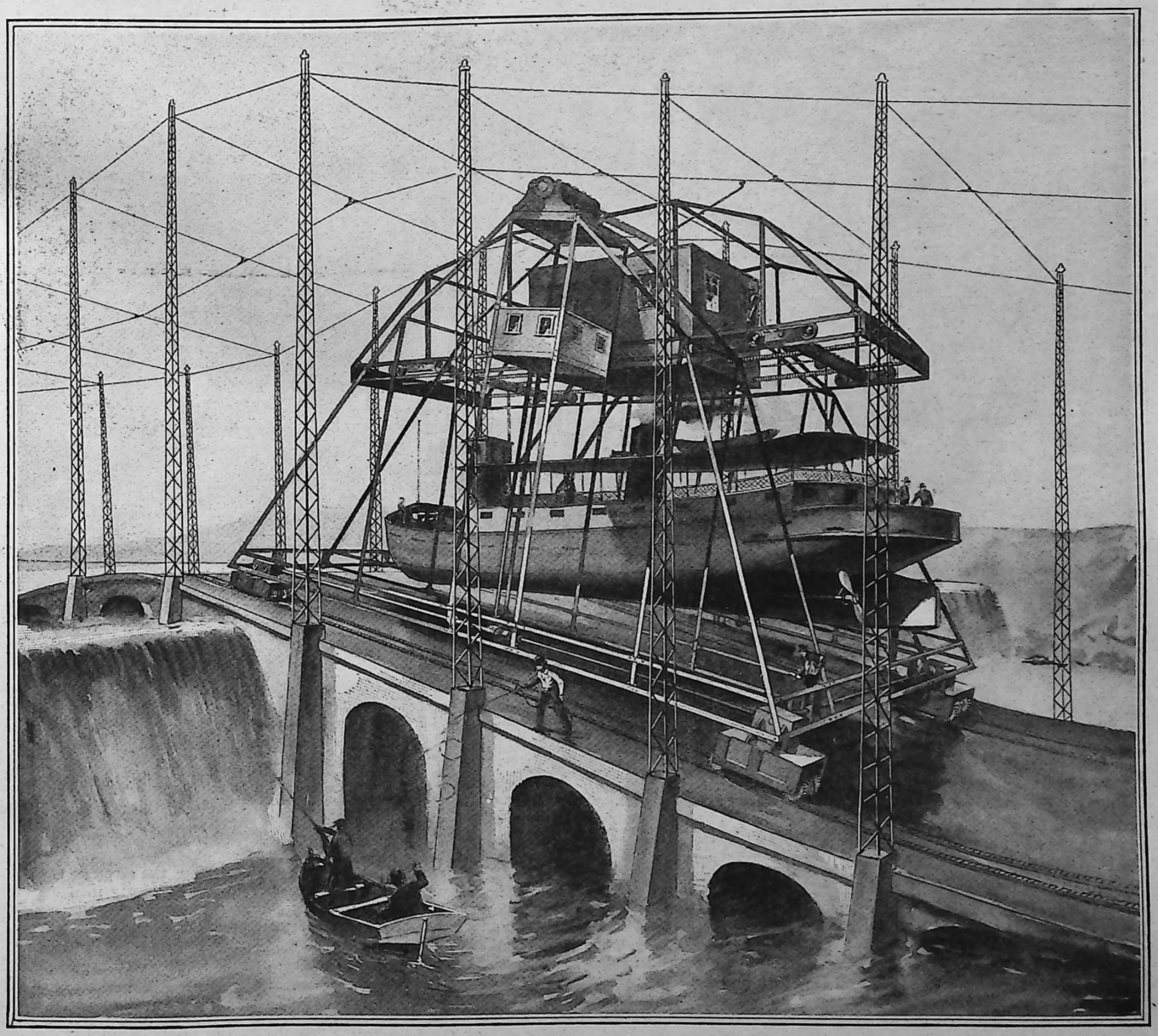
A MECHANICAL fish that can jump a dam is the idea of Johann Jargen Richard Haalck, who emigrated from Stelle, Germany, to this country about ten years ago. Many tributary streams would teem with life but for the spots along their course where canals or expensive systems of locks would have to be built.

The new idea would do away with such difficulties. Only a system of dams needs to be constructed, each dam being furnished with the mechanical contrivance for lifting boat, cargo and all, over the obstruction. Standardized forms of river boats would be used.

The boat-lifting mechanism is a structural steel framework composed of two triangular-shaped side members joined at the top by a horizontal transverse pivot-shaft; on this is mounted a bridge-like cradle. The two sides are made rigid by transverse girders, which also provide for mounting the whole upon four four-wheeled trucks running on a track laid on the bottom of the river and extending up over the dam.

The boat is hung from the overhead pivot-shaft by two bridge-like members that are suitably tied together by cross-girders and provided with a longitudinal track on which run two small carriages with pulleys over which the boat-lifting cables extend downward from the drums in the house mounted midway between the bridge members.

In operation the boat is first floated between the side members and under the lifting platform. Then the small carriages on the lifting platform are moved back or forth until the ropes drop perpendicularly, when they are connected with the special cables attached near each end of the boat. This done, the boat with its cargo is lifted by electrical power bodily out of the water. The framework is set in motion, the gear wheels toothed in the track so they cannot slip. Freedom to swing permits the platform to hold the boat in a horizontal position.



The mechanical arrangement for lifting vessels over obstructions in otherwise navigable streams: the boat, cargo and all, is bodily lifted out of the water and transported over the obstruction

Put Out of the Race by a Pirate of the Air

ATTACKED by a winged pirate, Lieutenant Etienne Poulet, competing in the recent air race from Paris to Australia, had a narrow escape from death while flying above the mountains on the Siam-Burma border. Bad weather had forced the French aviator to proceed at low speed, low for an airplane, and he was flying at an altitude of 1,000 feet above the mountain chain about 100 miles east of Maulmain in Lower Burma, when a huge vulture dropped from the clouds. After circling the machine as if maneuvering for position, the great bird hurled itself at the airplane. There was a crash, a cloud of feathers, and the vulture's body dropped earthward.

But, although victorious in the strange combat, the airplane was badly crippled. The vulture had charged directly into the right propeller. The resulting shock was more than the blades could bear. When it is recalled that in the American trans-continental race one machine was forced down because in a heavy rain-storm the propeller blades were worn away merely by contact with the drops, it is easy to understand the shattering effect of the impact of the huge bird's body. Poulet made the best landing he could in a jumble of mountain peaks. For days he was given up as lost, but he finally succeeded in repairing his machine, and limped into Maulmain —put out of the race by a bird.

The Gum that Gertie Chews

She can still get it for five cents in spite of the increased cost of manufacture

Photographs © International Film Servi

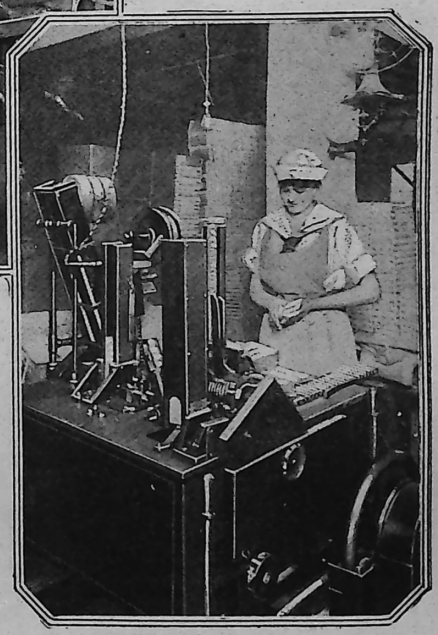
Does Gertie, as she rhythmically works her jaw, ever think of the life of the chicle she chews? It came first from a tree like this. A native boy is shown here cutting intersecting spiral grooves in the bark of the tree; the sap runs down into a bag at the base of the tree. He has been particularly busy since Nellie M. Horton, of Cleveland, Ohio, invented pepsin gum nineteen years ago

You've seen Gertie stretch her gum; but, as you see here, a native stretched it long before it came to her. The stretching is part of the cooking operation. Several bags of chicle are dumped into a large tub placed over a fire. As the water evaporates, the gum is stirred and then stretched to test its concentration

The gum is cut into cakes that weigh twenty-five pounds each, and is shipped from its native land, South America, to factories in its adopted country, the United States. The chewing-gum industry in this country is capitalized at over seventy-five million dollars, and there are at least seventy-five million gum-chewers

The thin slabs of gum are cut on this table. How Gertie must envy these girls their jobs! As for the oil-cans on the shelf, we must admit we're puzzled. Surely chewing gum is soft enough to need no lubrication other than that which the user gives it

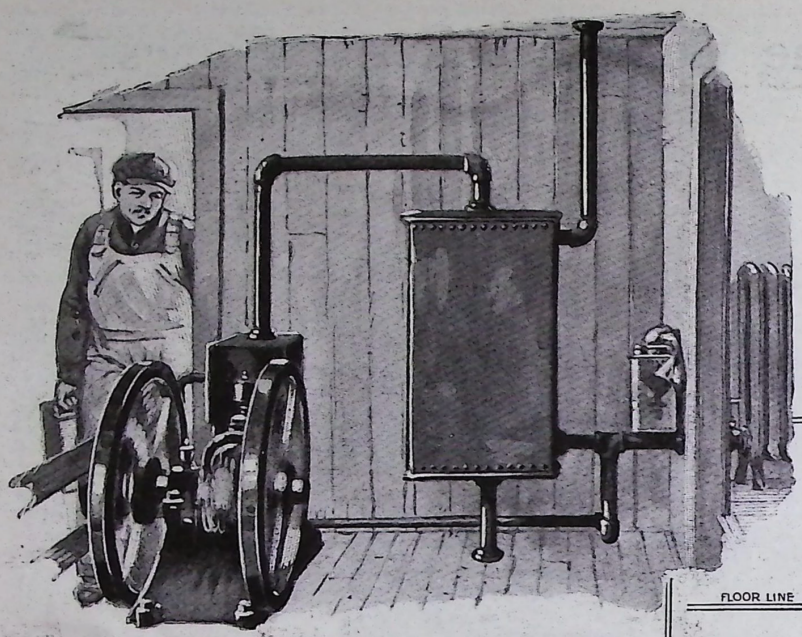
The cakes are sliced, flavored, kneaded, and rolled until they are quite thin; then they are run through a thinning-machine. The kneaders dress themselves up like bakers, and the inside of the gum factory looks much like a bakery



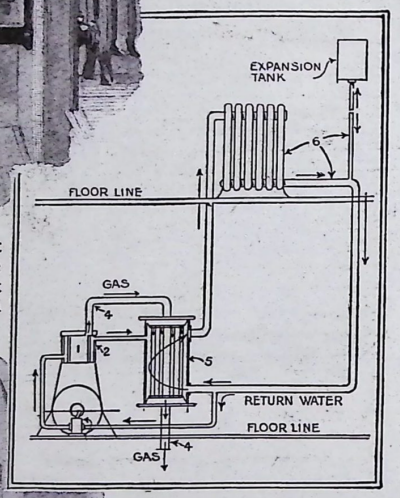
Slices of gum are dropped down the square column in the foreground. The machinery rattles, groans, moves in and out, and soon finished bundles of gum trickle out of a door below. Each slice is wrapped separately, and there are five slices to a package—all for a nickel!

A Few of the Many Done with the Exhaust

IN its September number the POPULAR *for the best answers to the following question: a Gasoline Engine?"—a first prize of $50, a the thousands of responses that came to the maga- Frank E. Covey for the first prize, the one by that by Clifford A. Butterworth for the third. number of illustrations, in the April* POPULAR *third prize letters are presented below, and in judges, are the next best. The contestants. A new contest*

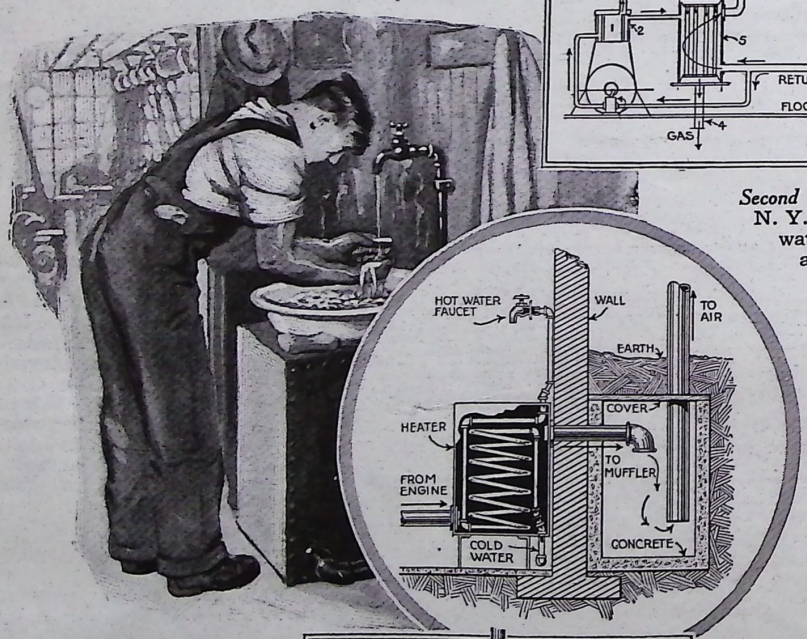


Helen E. Talbot, of Seattle, Wash., submits a heating system that gives a forced circulation of water in the system: 1 is the engine cylinder; 2 the water-jacket; 3 the circulating pump; 4 the exhaust pipe; 5 the exhaust water-heater; 6 the hot water heating system

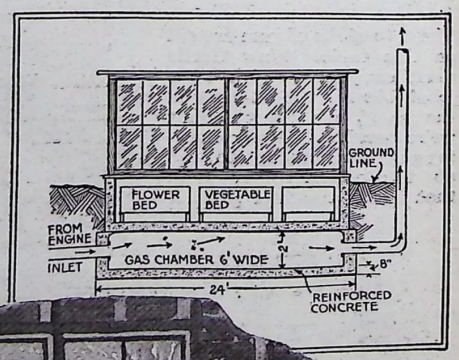


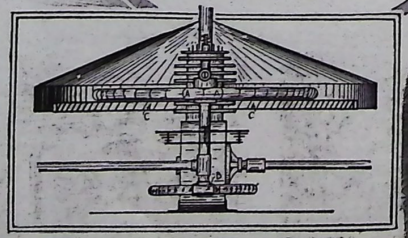
The Winner

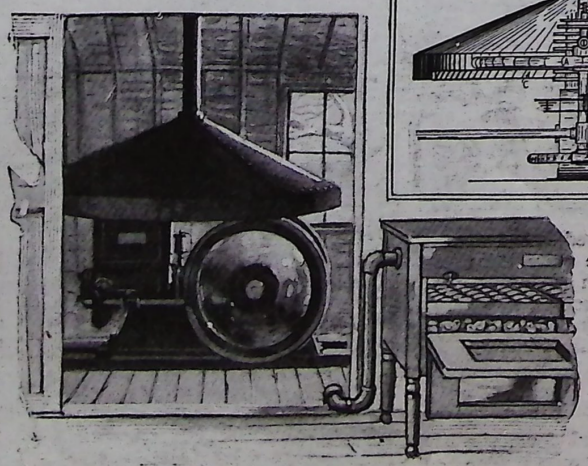
Frank E. Covey, San Francisco, winner of the first prize, submits plans for a complete internal-combustion engine in which the engine's exhaust is delivered to impact turbine buckets on the periphery of the flywheel. This article will be of great interest to the automotive and aeronautical industries. We have decided to give it an entire page of the April Popular Science Monthly.



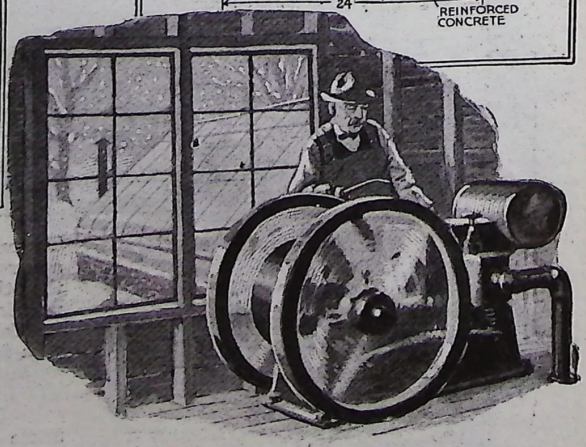
Second Prize. George M. Petersen, of Niagara Falls, N. Y., tells how to provide a machine-shop with hot water. The heater was made of sheet metal, with a copper coil of the instantaneous type. The cold-water pipe enters the heater at its bottom and runs up to the top, feeding down through the coil so that the direct blast of the exhaust will send it forth hot







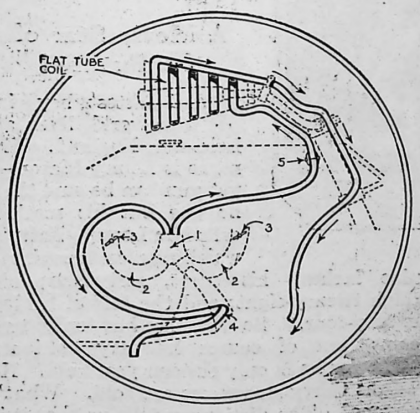
R. U. Clark, 3d, of Barnes Road, Newton, Mass., submits an apparatus for chick-brooding in connection with an air-cooled stationary engine. A small motor, covered with a conical reflecting dome and surrounded by coils of the exhaust, is its main feature



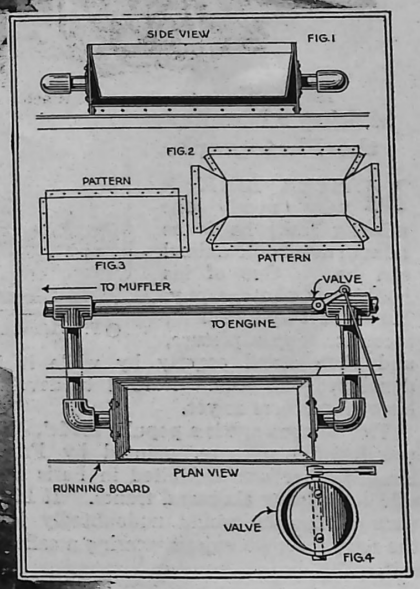
Paul L. Fetherston, of Milton, Wis., suggests plans for a greenhouse to be heated by the exhaust of a forty-horsepower kerosene engine, operated on an average of five hours a day. The heat thus stored is slowly radiated through the floor of the greenhouse

Things that Can Be of a Gasoline Engine

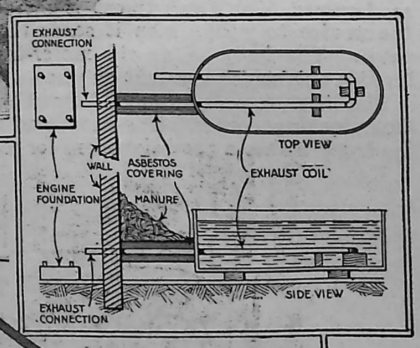
SCIENCE MONTHLY *offered three prizes "What Can You Do with the Exhaust of second of $25, and a third of $15. Out of zine the judges selected the one written by George M. Petersen for the second, and The first prize story will be printed, with a* SCIENCE MONTHLY. *The second and addition the five that, in the opinion of the editors thank both the winning and losing is announced on page 114 of this issue.*

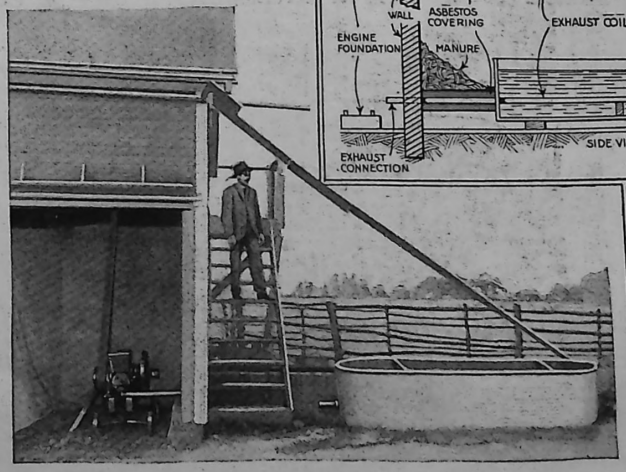


Third Prize. Clifford A. Butterworth, of Newton Center, Mass., made a cooker for touring. The construction is clearly shown in sectional view Fig. 1. Fig. 2 is the food-container, and Fig. 3 is the pattern for the bottom of the case. Fig. 4 shows the heat-regulating valve. The illustration shows how the cooker looks when mounted on the car



"In the cool days of spring and fall," says P. J. O'Neill, of Detroit, "the motorcycle is a very uncomfortable means of transportation, so I decided to utilize the heat from the exhaust of my engine to warm my hands and feet. No. 1 is a 1-inch pipe Y which was reamed to fit two pieces of 1¼-steel tubing; 2 and 3 are butterfly valves; 4 the shield; and 5 a flexible joint





Harry H. Phillips, of Waukesha, Wis., used the exhaust of a stationary engine to keep the water in a cattle-tank from freezing. He ran a single-loop coil of 3-inch galvanized iron pipe to 3 inches of the bottom of the tank, and connected it to the exhaust pipe of the engine. Needless to mention, it worked perfectly

© Press Illustrating Service

Making a Monkey of the Photographer

MASTER LINK is very nearly the missing link; he is as human as a dumb animal can be. One of his hobbies is photography. He will set up a camera, focus it, snap a picture, and then stand eagerly by while it is developed—he hasn't learned to develop his own pictures as yet.

This famous ape is a popular model. He posed for a picture, painted by Franz Simons, that was exhibited in Paris and sold for twenty thousand francs. If Link were a man he would undoubtedly join the navy; for he enjoys wearing a sailor's suit.

Tearing Down the Victory Arch

WHEN the war ended, New York built a great Victory Arch across Fifth Avenue; it cost forty thousand dollars. Under it passed New York's returning heroes and distinguished visitors.

But, now that New York has done all the victory parading it intends to, the arch is being torn down.

A Movie Star of the Future?

THE fattest boy in the world lives at Leicester, England. His name is Lenny Mason—yet you can be sure that no one but his mother calls him Lenny. Fatty's waistline measures sixty-nine inches; his chest, sixty-four; his thigh twenty-eight; and the calf of his leg twenty-four. So far, he has only two chins, but of course he may cultivate more, for he is only sixteen years old. He weighs thirty stones, we are told. What's a stone? The dictionary tells us that it is about fourteen pounds. Thus Fatty's weight, translated into United States English, is four hundred and twenty pounds!

Where the Office Seeks the Man

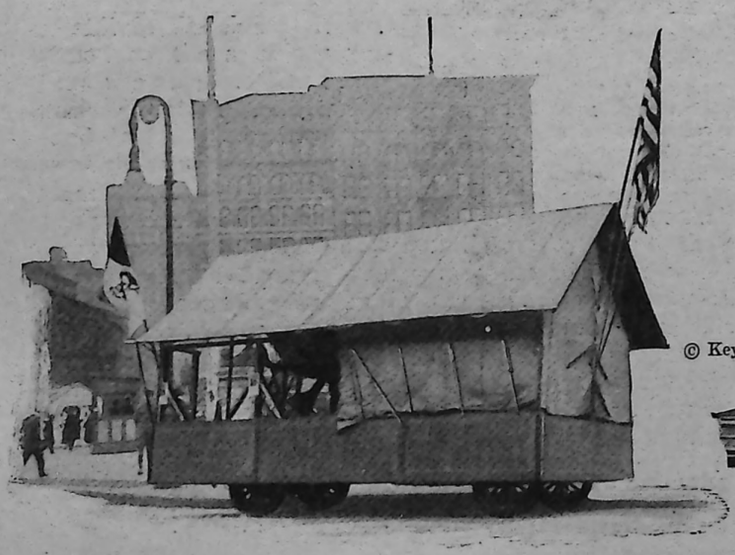
"GO two flights up and see the sergeant," used to be the direction given the would-be soldier or sailor; but a modernized War Department is more businesslike. To "sell" the service to young men it sends the recruiting office out after them. The body of an old motor-truck forms the foundation for this one, which is a tent on wheels.

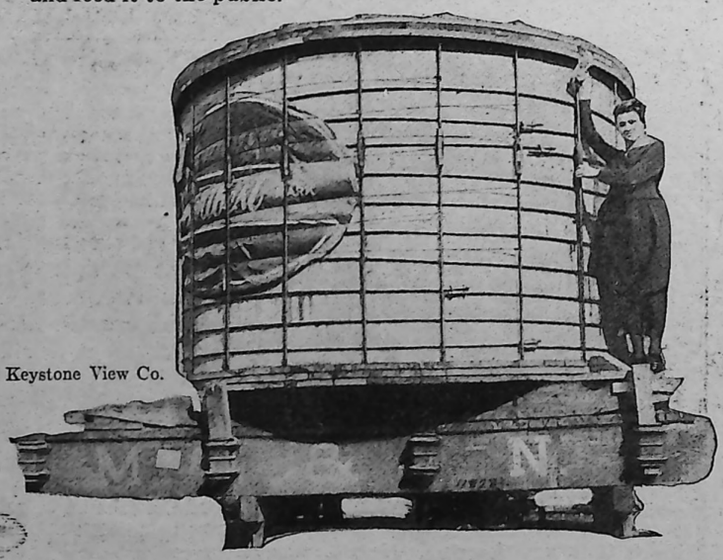
The tent travels around New York city, stopping at any likely-looking corner. The outside of the platform built around the truck makes a good signboard for recruiting slogans.

Enough Cheese for a Lifetime

A BIG cheese! Most of us have called our enemies that at some time. But did we realize what we were talking about? A big cheese—in fact, the biggest cheese—is shown in the picture below. It weighs more than forty thousand pounds, and is ten feet in diameter.

We are told that it was "built" by Mr. N. Simon for the National Dairy Show in Chicago. It was held together by metal rods and bands. It was planned to open it at the show and feed it to the public.



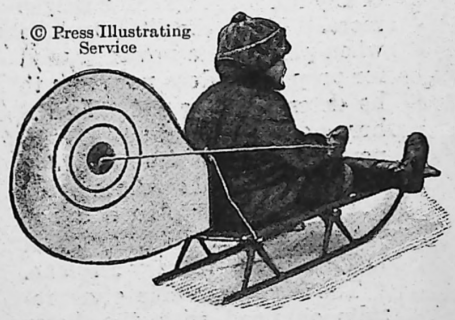


© Keystone View Co.

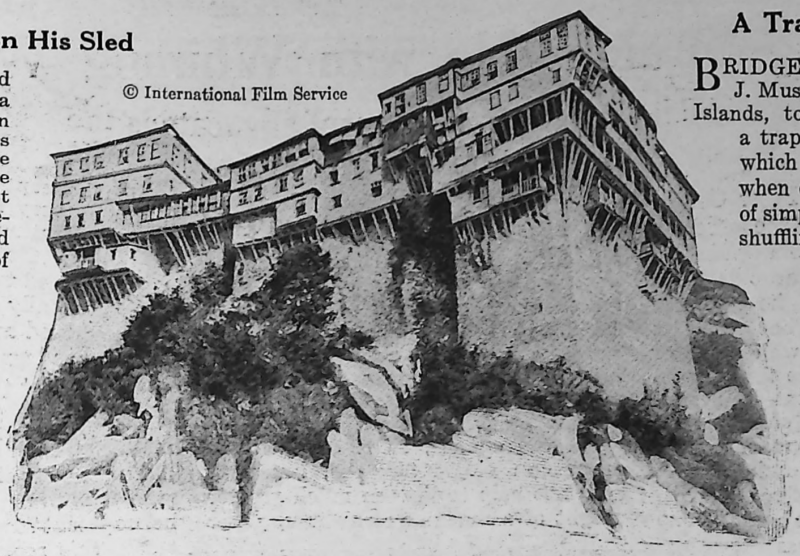
He Put a Rudder on His Sled

SLEDS that are steered by the rider pushing a bar at the front came in just in time to save fathers from bankruptcy as shoe prices soared. But one youngster at least wasn't satisfied with this improvement on the old-fashioned heel-and-toe method of steering.

"My sled just flies down the hill," he was boasting, when his ear was caught by the word "fly." That naturally suggested airplanes, and airplanes as naturally suggested—well, look at the picture. Thus are inventions born. The result was an aerial rudder, which the inventor says is not only good fun, but a real advance in steering apparatus for sleds.



© Press Illustrating Service



© International Film Service

No Females Allowed on This Holy Mountain

CLINGING to the cliffs at the top of Mount Athos, in Greece, the wooden rookeries shown in the picture above may be considered the most modern thing in cliff dwellings or the most ancient in skyscrapers, depending on the point of view. The clustered buildings house the Rossikon monastery. The population of Mount Athos is about six thousand, of whom perhaps half are monks. Not only women but all female animals are excluded from the holy mountain.

A Trap-Door for Cards

BRIDGE fiends inspired Frederic J. Muspratt, of St. Helier, Channel Islands, to invent a card-table with a trap-door in the center through which the cards may be dropped when each hand is over. Instead of simply picking up the cards and shuffling them, you fish around under the table's edge for a lever, pull it, and wait till all the cards have disappeared before you let go. Then you gather the cards from the tray. The object of the device is speed.

We doubt the efficiency of this trap-door method of gathering cards; but by accidentally moving the lever you might rid yourself of a bad hand.

Gid-dap There, Llama

LLAMAS are used in South America as beasts of burden. But when a few choice ones are picked out for foreign Zoos, they quit work entirely and lead a life of luxury—except in some of England's Zoos.

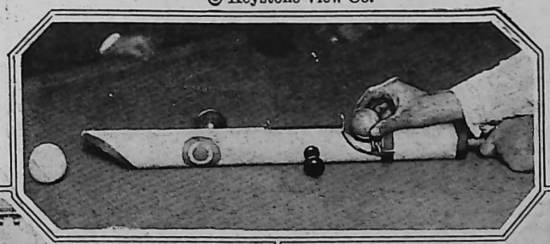
There they are harnessed to a wagon for amusing children. The head keeper of their new home trained them to draw a wagon, and now every day they travel the paths of the Zoo, carrying a load behind them. The llamas may not like it, but after all it is for their own good; we have long been told that "idleness is the devil's workshop."

I'll Shoot You a Game of Pool

THEY are making the game live up to the phrase in some New York pool-rooms, where "machine-gun" pool has been introduced.

Inside the barrel of the pool gun is a miniature cue driven by a strong spring. The player places his cue ball in the gun, aims at the ball he hopes to drive into a pocket, and fires. The pool gun has sights to help direct the aim.

© Keystone View Co.



Josephine the Joy-Rider

BELOW you see Josephine riding in an automobile. Josephine is a cow of the Jersey persuasion, and her chauffeur is a Baptist minister of Bolivar, Mo. A member of his church gave Josephine to the minister on condition that he would carry her home in his car.

Both rear doors of the car were dropped open and the floor between the seats was filled with straw. A temporary chute was constructed, and the cow was led into the car and securely lashed fore and aft. She stood up most of the way home, her feet resting on the running-boards on each side of the car.

Flying Straight Up with Whirling Wings

The helicopter's most recent advocate is the scientist and inventor, Peter Cooper Hewitt

By Marius C. Krarup

A NOTED scientist, Peter Cooper Hewitt, inventor of the mercury-vapor electric lamp, recommends flying on the plan that Leonardo da Vinci said he would adopt if he had the power. In other words, Cooper Hewitt advocates a helicopter, which means that his machine is to be lifted by a screw propeller which rotates horizontally to obtain lift and obliquely to obtain both lift and propulsion. By twirling a toy propeller in the fingers with its shaft at forty-five degrees, one observes that when the blade on one side is in a position that gives lift, the other blade is in a position to give propulsion. By varying the angle of the shaft, lift and propulsion can be obtained in different proportions. The machine goes straight up when the shaft is vertical, and it flies horizontally when the shaft is inclined so that the lift produced is just sufficient to keep the machine suspended.

If only one helicopter screw were used, the engine driving it would spin itself around in the opposite direction. Half the power would be wasted and the pilot much discomfited. The plan therefore calls for two screws mounted on telescoping shafts and driven in opposite directions. For inclining the double shaft at the will of the pilot, one or more auxiliary small screw propellers may be used. When the engine and body of the machine are hung considerably below the helicopters, as in the testing apparatus shown herewith, the push required at the level of the engine for slanting the main shaft can be very moderate. Once the machine flies horizontally by this means, the wind resistance against the body helps to maintain the slant. If it is reversed by the auxiliary propellers, the machine flies in the opposite direction. All steering, up and down and sideways, can thus be accomplished by managing the slant, but Mr. Hewitt does not as yet disclose the mechanism that he proposes to employ for this purpose.

When a surplus of power is suddenly applied, the machine jumps in the direction in which it is aimed, as it has only its weight but no great areas of body and wings to retard it. If the power gives out, the machine falls; but the helicopters prevent spinning, having opposite pitch, and break the velocity of the descent somewhat.

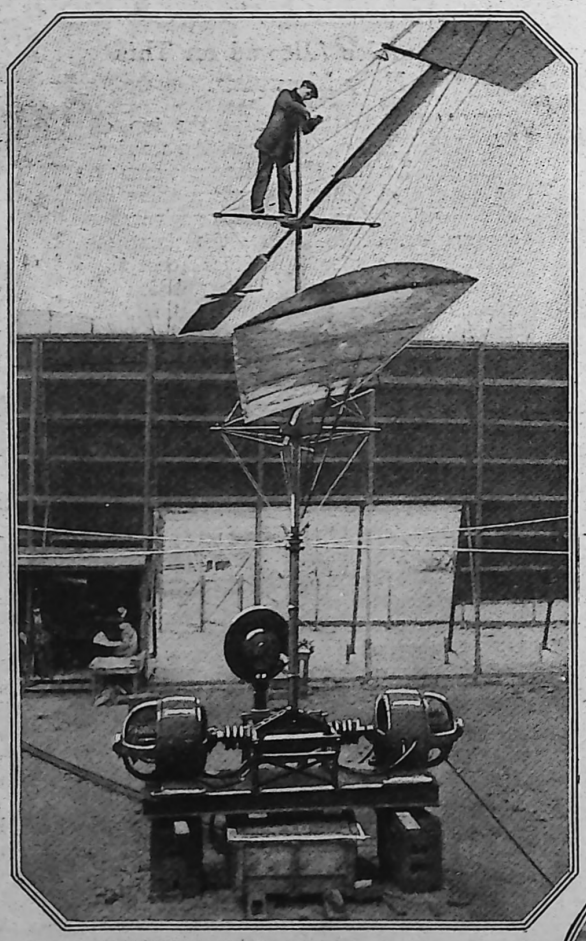
So far, the helicopter plan has had no followers except in theory, mostly because the lift thrust obtainable from an ordinary propeller screw is very small. It is difficult to get more than a 200-pound thrust from an eight-foot propeller at one thousand revolutions a minute. This small thrust will operate at great forward speed when given the chance, as is done in the propulsion of an airplane, but that does not help to lift the much greater weight of a machine straight up, ever so slowly. For that purpose the thrust must exceed the weight. And to use many small helicopters in one machine is practically impossible. It is particularly difficult to slant them all, for propulsion. Besides, small helicopters revolving at high rotary speed are at best very inefficient. The centrifugal forces are troublesome and wasteful.

The extensive experiments made by Mr. Hewitt show the only way in which helicopters can be used. They must be very large. Those shown in the illustration are fifty-one feet in diameter. The four blades are twelve feet long and two feet six inches wide. They are really airplane wings mounted to be whirled around. The maximum rotary speed used is seventy revolutions a minute, but this gives a linear speed of one hundred miles an hour at the middle of each blade.

To get a lift of 2,550 pounds with this machine it is necessary to rotate the helicopter at 70 revolutions a minute and this requires 126.5 horsepower. At 46.5 revolutions a minute the power is more efficient, since at this speed 44.4 horsepower lifts 1,300 pounds, but this lift is not of any use if the machine weighs more. What the lift must be when part of the power is used for propulsion does not seem to be determined as yet. If 126 horsepower is required for supporting a machine weighing 2,550 pounds and more for flying it, the helicopter plan does not yet promise an efficiency equal to that of an ordinary airplane.

The following table gives results obtained with the Peter Cooper Hewitt helicopter testing apparatus:

Revolutions per minute	Lift in pounds	Horsepower	Pounds of lift per horsepower	Velocity in feet per second at 20-foot radius
46.5	1300	44.4	29.3	97.5
56.5	1800	75.4	23.9	118.3
63	2150	98.4	21.8	132
70	2550	126.5	20.2	146.5

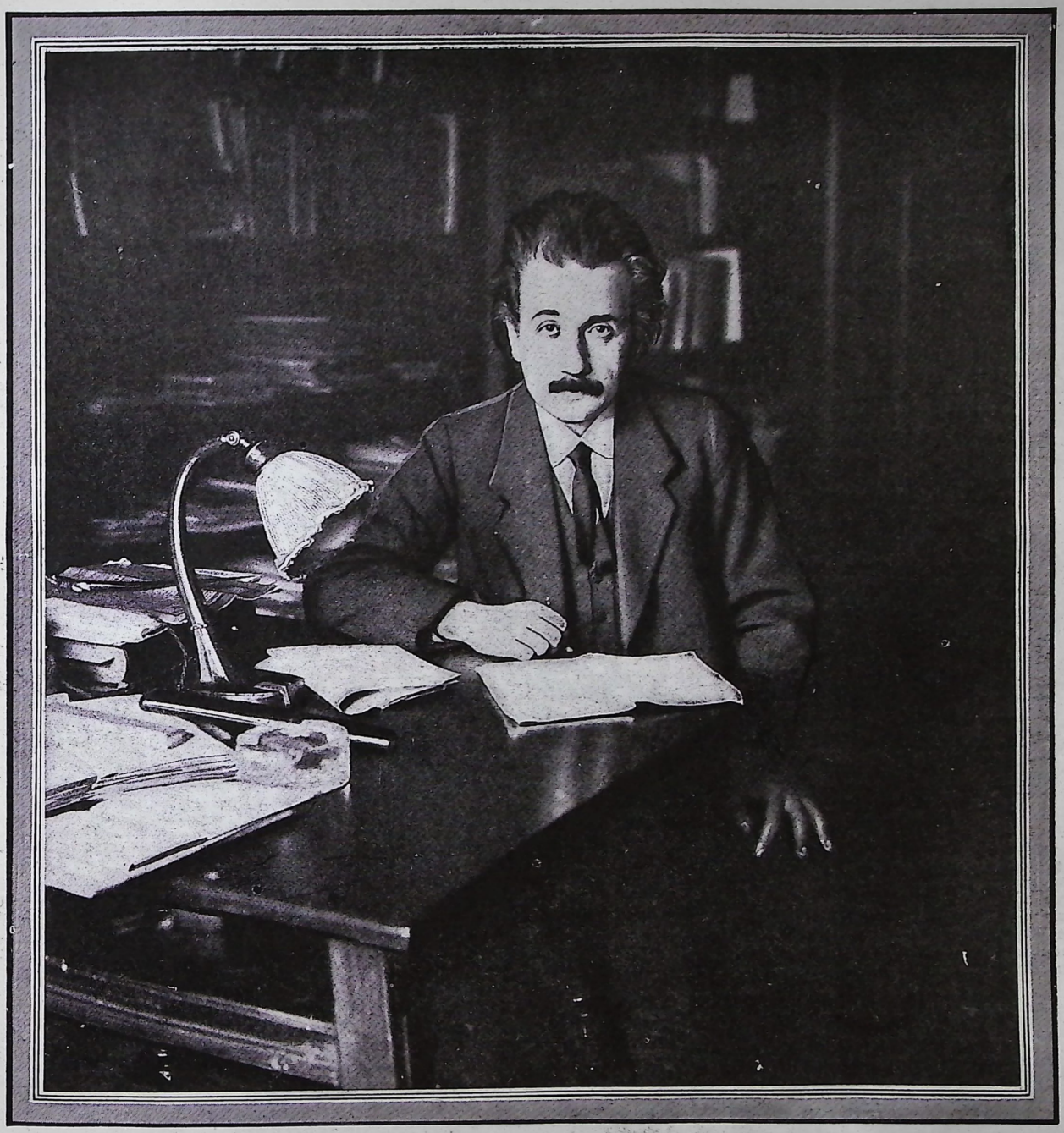


© International Film Service Co.

P. C. Hewitt's helicopter test machine. When the electric motors are replaced by engine and auxiliary propellers for starting the helicopter mast, and when room is made for a pilot, this apparatus becomes a flying-machine

© Press Illustrating Service

During a recent test of his helicopter flying-machine, Mr. Hewitt was accompanied by Thomas Edison, who displayed a keen interest in the invention



Once They Would Have Burned Him at the Stake

MEN have been tortured and burned at the stake for upsetting ideas. Galileo and Copernicus had a hard time of it in their day. Now comes a revolutionist, an idea-upsetter as great as any. He is Professor Albert Einstein, and his idea-upsetting "theory of relativity" will make it necessary to rewrite Newton's laws of gravitation and every text-book on physics.

Einstein starts with two suppositions. One is that all motion is relative. In the cabin of a ship you cannot tell whether you are moving or not without looking out of the window. Is a man who is walking from stem to stern of a ship at the same rate that the ship is moving in the opposite direction standing still or not? If astronomers could not see the stars, they would not know that the earth is moving.

Einstein's second supposition is this: The speed of light (186,000 miles a second) cannot be increased or diminished. This is like saying that the speed of a rifle bullet is always the same when it is fired forward or backward from an airplane going at one hundred and twenty miles an hour. Nothing can be faster than light. Newton says that gravitation acts instantaneously throughout space. "No," says Einstein, "the action of gravitation is not instantaneous; it cannot exceed the velocity of light."

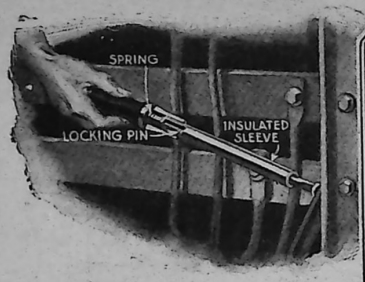
What is your size? What is your shape? "Tell me how fast you are moving and in what direction," says Einstein, "and I will answer. If you are traveling vertically upward at the rate of 136,000 miles a second, you are not six feet tall, as you supposed, but just three. But horizontally you will measure six feet. It is no use to bring in a standard yard-stick and start to measure, for that too contracts and measures only a half a yard vertically held."

Light is a form of energy. Therefore, says Einstein, it must have mass and must be affected by gravitation. In other words, you ought to be able to weigh light. But how? It moves so fast that it cannot be weighed on the earth. If we could see a star close up to the edge of the sun, a ray of light coming from the star would bend under its own weight, and the star would be seen, not where it actually is, but a little bit to one side. During the last solar eclipse exactly what Einstein predicted happened. A light from a star was deflected, just as a bullet fired from a gun gradually curves toward the earth. We can safely speak of a pound of light now. As a matter of fact, the sun showers on the earth 160 tons of light daily.

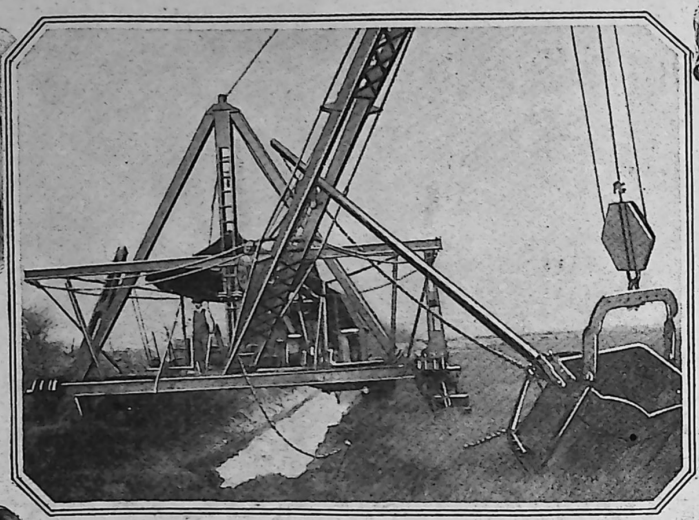
Other astonishing consequences follow as soon as Einstein's theory of relativity is accepted. Straight lines do not exist. They are parts of gigantic curves. Travel fast enough on a straight line, and you will come back to your starting-point. It would take a beam of light 30,000,000 years to describe a complete circle.

All this seems like sheer nonsense. *And yet, Einstein's statements have been proved to be true by experiments!* You have been living in a dream world. Your conception of time and space are true only within limits. "Wake up," says Einstein, "and acquaint yourself with the real world."

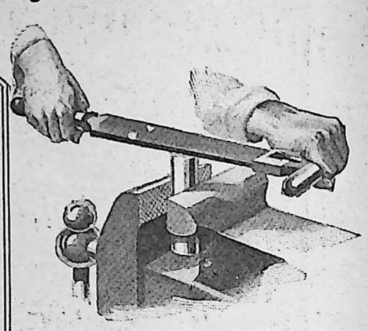
Do It with Tools and Machinery



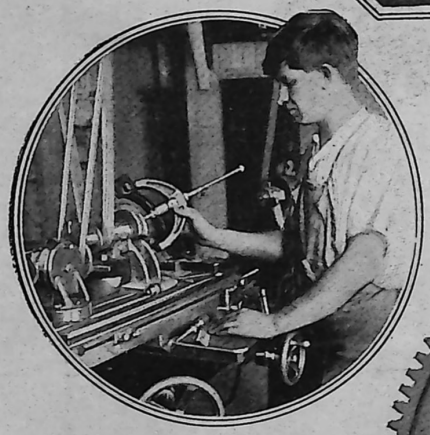
John Weaver, of Baltimore, has invented a completely insulated screwdriver, something that has long been in demand by the electrical trade. Should the device slip on live circuits, it is rendered harmless by its insulated shield



A transporting attachment permits the dredge to be propelled backward with the same facility as forward. The dredge rests upon skids on top of which are steel rails, the skids sliding forward by belt and pulley power from the engine of the dredge

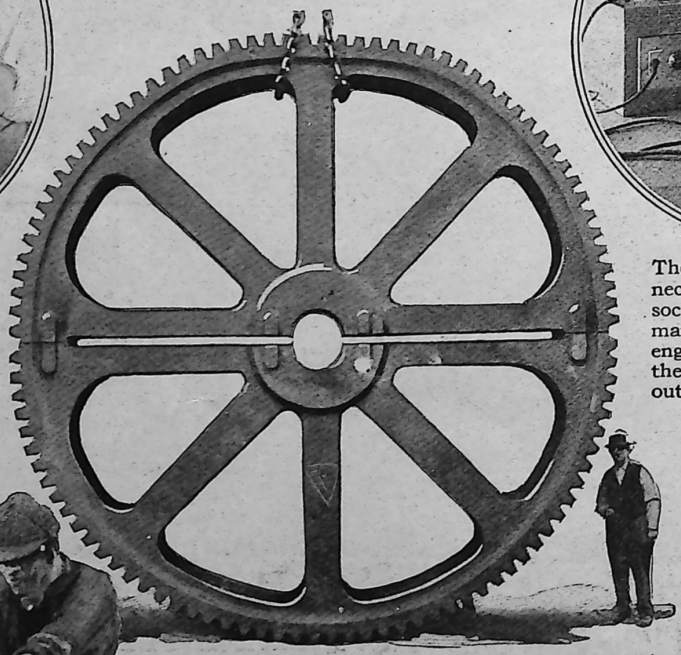


A recent improvement is this extra handle to be attached to a file and permitting it to move backward as easily as it does forward



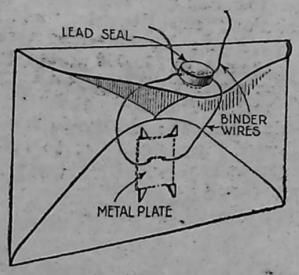
A grinding-wheel dresser, so made as to produce the proper form of wheel for grinding various radii, has recently been placed upon the market. The illustration above shows the dresser in operation

The operator plugs the connecting cord into the light socket, lays the metal to be marked upon the electrical engraver's contact plate, and the engraving is made without wax, stamps, or acid

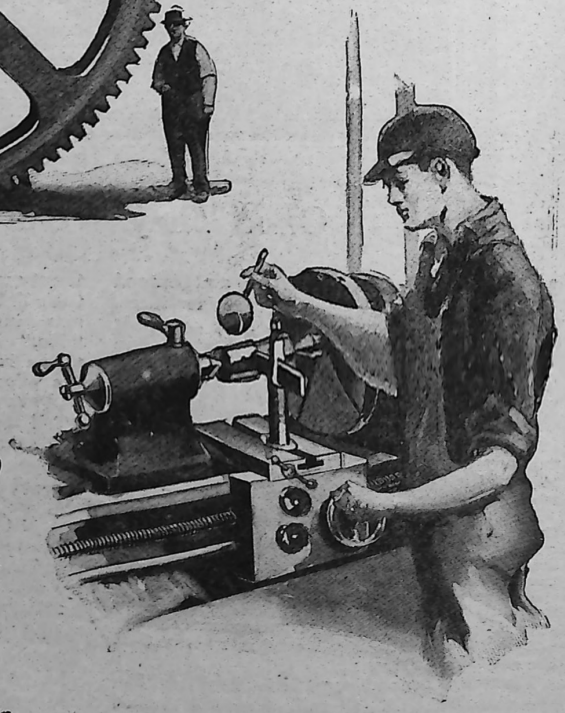


This gear was cast in one piece and then cut in two. Its diameter is 16 feet 8 inches, and its weight 70,000 pounds. The teeth are 28 inches across and there is room for a man's arm between two of them

Driven into the tree to be cut down, this saw oiler lubricates the saw automatically as it passes back and forth beneath it

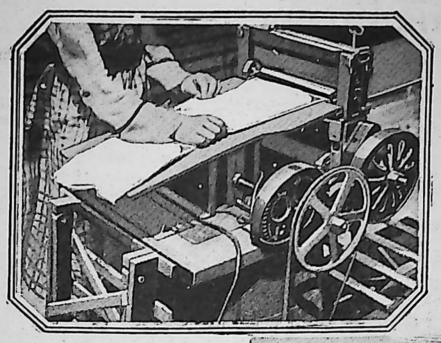


A clip that is shaped from thin metal and provided with prongs for securing the back part of an envelope or binder

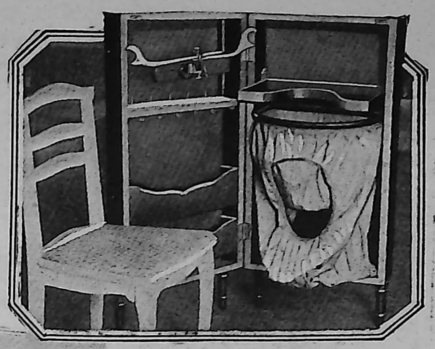


A magnifying mirror for shop use: it is adjustable to any angle, and can be inserted in a surface gage or other instrument

Inventions that Will Help Make the Housewife's Job Less Hard

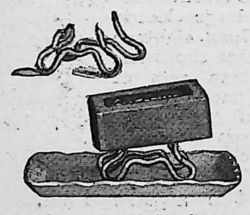


Here is an electrically heated clothes-mangle: attached to the washing-machine wringer; it is said to do the family ironing in one third the time formerly taken



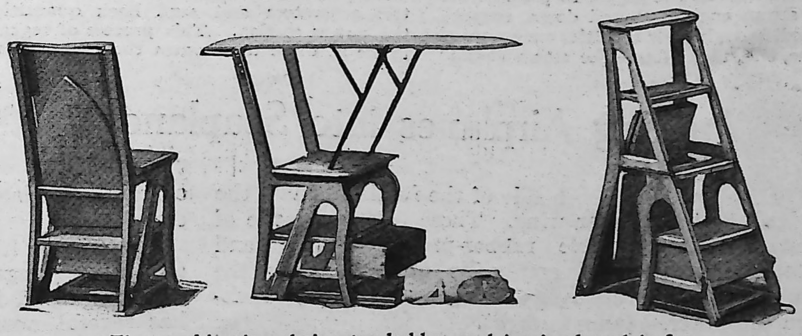
This little sewing-stand, with its hanger places for spools, scissors, and sewing material, folds up exactly as would a book, and hides behind the door when not needed

A new bath-tub is so designed that it offers the occupant either a head-rest or a seat at one end of the tub



An unusual but very practical soap-holder is shown here. The cake of soap is simply set upon the prongs, which prevent it from slipping

For the theater and the home is this automatically closing bag, hat, or program holder. When not in use the spring lug snaps back into the pear-shaped holder

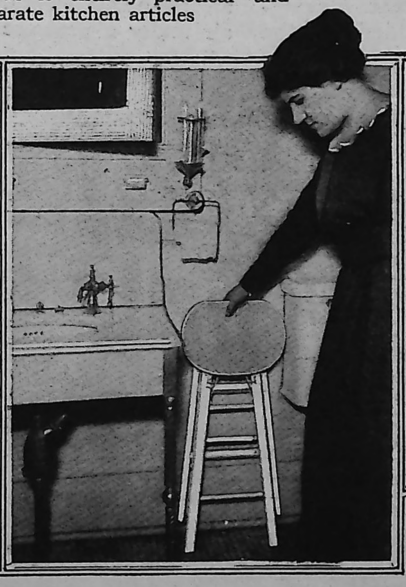


The combination chair, step-ladder, and ironing-board is for the two-by-four apartment. It is entirely practical and saves buying three separate kitchen articles

The fumes of burning benzine cause the metal in the perforated box to glow for eight hours at a time, making this little hand-warmer a useful thing in the cold weather

© International Film Service

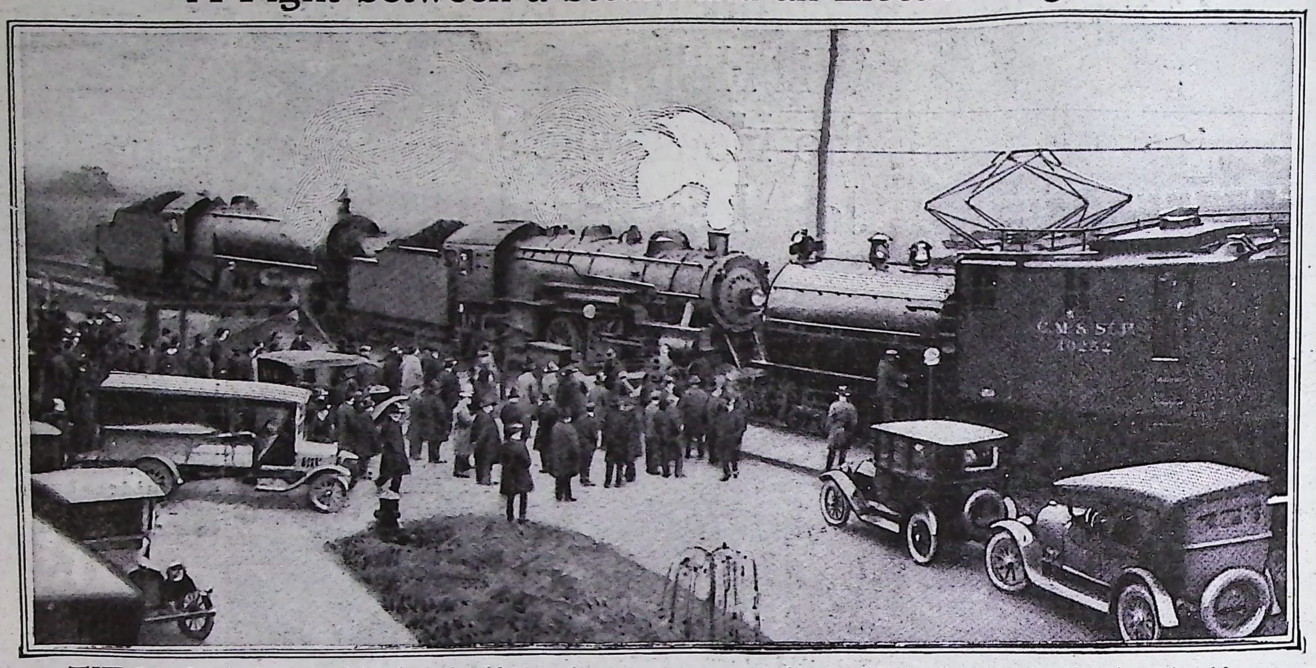
The ashes from the kitchen range are placed in a sifter built almost like an ice-cream freezer: The sifter is made air-tight



This folding stool for the bath-room is set compactly against the wall, out of the way, when not in use: Very useful in small bath-rooms

Push down the pin, insert the rubber cork into the neck of the bottle, release the pin, and the cork will expand sufficiently to cork it: It will fit any bottle of reasonable size

A Fight between a Steam and an Electric Engine



THE fight for the heavy-weight championship was about to start. Down the tracks from opposite directions came the fighters—a great two hundred and sixty-five ton electric locomotive versus two monster steam locomotives. When the gong sounded, the steam locomotives started up and shoved the electric one down the track. Then the power was turned on in the electric, and it began to push in the other direction. The steam engines slowed down, stopped dead, and then retreated, though their throttles were opened to the last notch! One, two, three, four—the steam engines were counted out, and the electric won the championship. This powerful engine is one of the new gearless electric passenger locomotives that are being built by a large electric company at Erie, Pa. It is seventy-eight feet long, eighteen feet high, and has a horsepower of more than three thousand. There are fourteen motors that turn fourteen sets of driving wheels. And these motors may be used as electric generators and send back quantities of "juice" to the power station. This process of regeneration acts as a brake at those times when the engine is traveling downhill

Turning Airplanes into Seaplanes

IMAGINE yourself aboard an airplane, crossing a wide stretch of water. You are enjoying the scenery, when suddenly the motor begins to stutter. A few half-hearted explosions, a grating sound, and—the engine stops. If you are flying low and far from the shore, you must face a landing on the water.

Lower and lower soars the airplane; the wind whistles past the bracing-wires—suddenly the machine hits the water with a tremendous crash. Half a wing is carried away by the waves. But you are safe—for the time being. In a few minutes the machine settles lower and lower in the water. Then, when you have given up hope, a hum is heard in the sky, and a giant flying-boat lands close to you and takes you off the wrecked airplane.

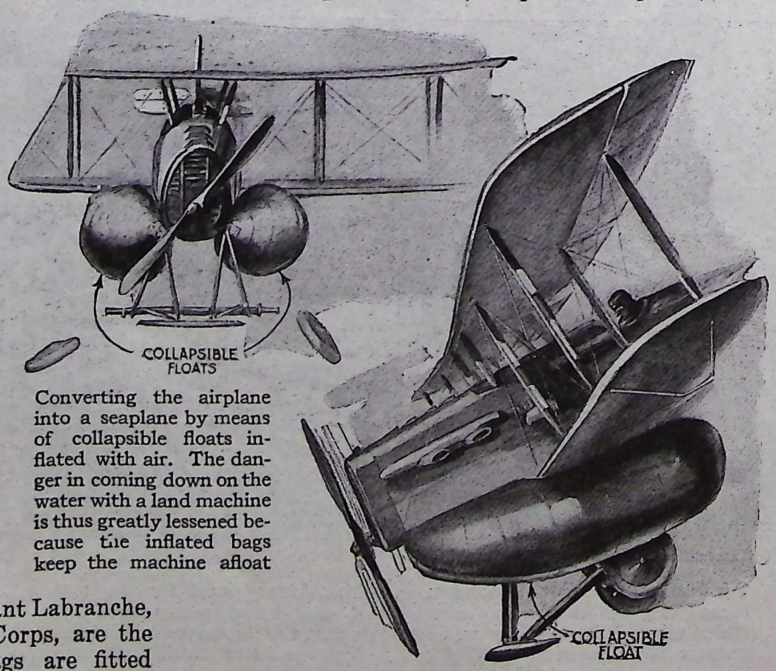
Buoyancy bags, a new invention, will soon be found on every machine that has to traverse wide stretches of water. Colonel Busteed, of the British Air Service, and Lieutenant Labranche, of the French Aviation Corps, are the inventors. Two air-bags are fitted on each side of the fuselage, under the lower wing. These bags are made of flexible rubber-proofed fabric, and when empty lie quite close to the fuselage, offering scarcely any resistance in flight.

The bags are inflated by means of an air-bottle containing compressed air under a pressure of 2,000 pounds to the square inch. Since the bottle is very small, to save weight, it does not contain sufficient air to fill the bag completely.

In order to increase the volume of air, a very ingenious device, known as an injector, is used. This injector has several nozzles which communicate with the outside air; when the valve on top of the steel bottle is opened, air rushes at tremendous speed into the injector and then into the bag, which becomes rigid.

A landing vane, about one foot wide and five feet long, is fitted in front of and below the air-bags. This glides over the water, just as the bottom surface of a seaplane floats, and absorbs also the most severe shocks, which otherwise might burst the air-bags.

In some machines, the inflated bags might foul the landing wheels of the airplane; a special device is used in such cases, which enables the pilot to throw the wheels off just before inflating the air-bags.



Converting the airplane into a seaplane by means of collapsible floats inflated with air. The danger in coming down on the water with a land machine is thus greatly lessened because the inflated bags keep the machine afloat

Ripples of Life and Waves of Death

The world is full of them; waves visible and invisible, waves inconceivably short and immeasurably long

By Alfred J. Lotka

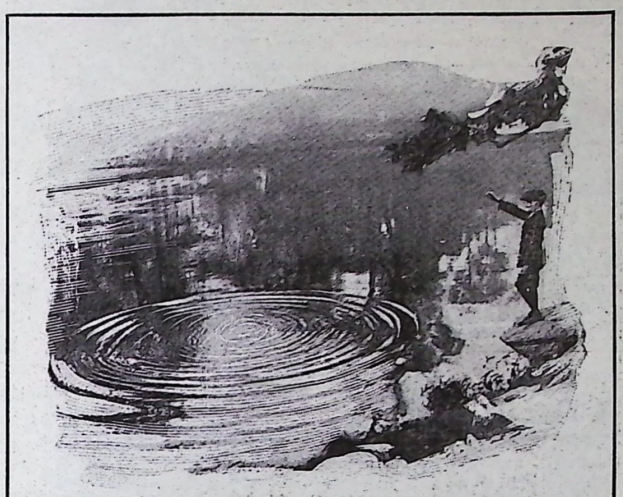
YOU may whisper in her ear or you may wireless to her in Honolulu; it makes no difference—it is only a ripple, anyway.

I am not speaking of the *substance* of your message, but of the *means* by which it is conveyed. In either case, it is carried to its destination by a wave. Of course, there are waves and waves. A whisper is a sound wave measuring only a few inches from crest to crest, while the electromagnetic waves used in wireless telegraphy may be several thousand feet long.

The world is full of waves—waves visible and waves invisible; waves inconceivably small; waves of ordinary dimensions; waves so long that the imagination stands aghast in the effort to picture them; waves in the water, waves in the air; waves in the solid earth, and waves in the empty space between the stars.

The most familiar of these are the waves on water. Look at water waves and you can form a mental picture of some others that occur in nature—most of them either quite invisible, or else visible only under very special circumstances.

If you throw a stone into a pond, an ever-widening train of circular waves spreads in all directions. The waves, then, in this case are circular and are propagated in two dimensions only, for they cannot leave the surface of the water and travel out into space.



If you throw a stone in a pond, an ever-widening train of waves spreads in all directions. The waves have two dimensions only. A somewhat similar wave action takes place when you strike a bell

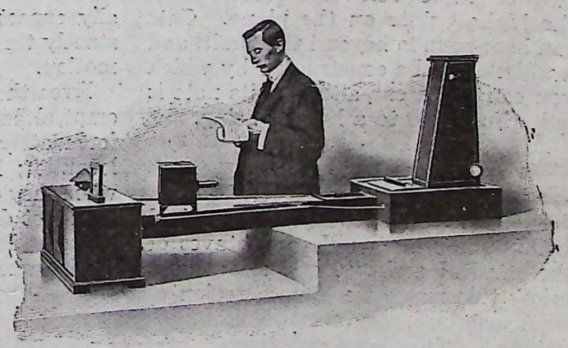
Making Your Eyes See Sounds

Something similar happens if you strike a bell, for example. The bell is thrown into vibration by the blow: you discover that if you touch the bell with your finger immediately after striking it. The vibrations of the bell are communicated to the air around it, and a wave ripples out in all directions. If it reaches your ear you say: "I heard the bell strike."

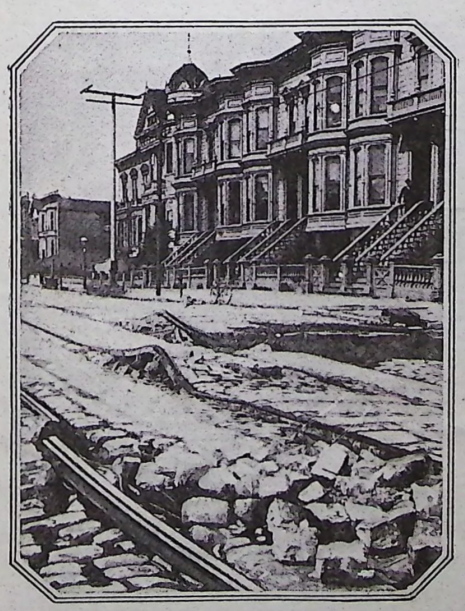
In this case, if there are no obstacles, the sound spreads approximately evenly in all directions; in other words, the waves are not circles, but spheres. Though your ear detects these waves, they are ordinarily quite invisible. Yet you can be made to see them by special devices. Professor Foley, of Indiana University, has obtained some exceptionally fine photographs of sound waves. As a sound wave in air moves at a speed of about 1,100 feet a second, or 750 miles an hour, and as it is quite impossible to point your camera and work a shutter by following the wave with the eye, it requires special ingenuity and skill to secure a photograph. The feat is accomplished by pointing the camera at the source from which the sound proceeds, and making a flash of intense light immediately after the sound is produced. The particular sound used in the experiment is the loud crack of a powerful electric spark, and the flash of light is given a very small fraction of a second later by another electric spark sprung between magnesium terminals to render it intensely luminous.

Try It on Your Piano

Just as the waves on water vary in height or amplitude, and also in length as measured from crest to crest, so sound waves differ in amplitude or loudness and also in wave-length or musical pitch. An ordinary piano keyboard extends from the note *A* three octaves and a half above the so-called "middle *C*," the note on the first ledger line below the staff in the violin clef and four octaves above this to the top note of the piano, again a *C*. The string that sounds the middle *C* vibrates 273 times a second at concert pitch and sends out waves measuring $\frac{1100}{273} =$ 4 feet in length. The wave length is halved every time we go up one octave. Hence the wave length of the topmost note on the piano, four octaves above the middle *C*, is $\frac{4}{2^4} = \frac{4}{16} = \frac{1}{4}$ ft. = 3 inches. Similarly, the wave length of the lowest note (*A*) on an ordinary upright piano is nearly 39 feet. The



The earth writes its autograph with this instrument—a seismograph. Daily waves in the earth are thus written down for the scientist to study



Probably not a day passes without an earth wave. Fortunately, most of these are very slight. This picture shows car-tracks and cobblestones torn up by a recent earthquake

lowest note on some of the largest organs is the *C* an octave and a half below this, sounded by a 64-foot open pipe. Its wave length is 128 feet, and it gives only 8½ vibrations a second.

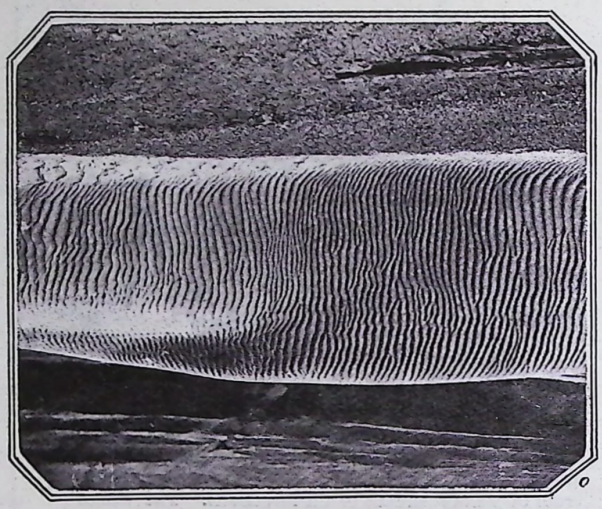
It is doubtful whether the ear truly recognizes the pitch of the notes at the extreme ends, both above and below, of the full range of a great organ. Even on the piano it is difficult to recognize a melody played, say, on the three lowermost notes. And if we go a little further down the scale of vibrations, we cease to recognize them as sounds at all—at most, we may become conscious of a kind of rumble. At the upper end of the scale, too, a point is first reached where we are unable to distinguish musical pitch, where we can still hear a note, but are unable to place it in the musical scale. Then beyond this come vibrations that the human ear does not perceive at all. This limit of audibility varies considerably in different persons, but corresponds to a frequency of about 24,000 vibrations a second or a wave length of one half inch, a note two or three octaves above the highest note on the piano. Cats can hear sounds beyond this limit, and a whistle can be constructed by which you can call a cat, although its note is quite inaudible to a human being.

Sounds that You Can't Hear

Audible sounds, then, are comprised within some ten or eleven octaves of the musical scale. Both above and below this range we have a region of what may be termed "inaudible sounds." That is to say, there are waves that, just like the audible sound wave, consist of alternating layers of compressed and rarefied air traveling out from a vibrating body, but to whose wave length our ears are not attuned.

Is there any limit also to these inaudible sound waves? The answer is that there is, at any rate, an upper limit, for a wave only one tenth of an inch long can be started, but by the time it has traveled about an inch its intensity ("loudness") has fallen off to only one hundredth of its initial value. Such exceedingly short waves, then, if they occur at all, can never travel more than a very short distance. In contrast with this, sounds of ordinary wave length have been heard over very long distances. Thunder may sometimes carry as far as twenty miles. In the World War the boom of big guns was heard at a distance of more than three hundred miles. In the year 1883 the top of the Krakatoa mountain in the East Indies was blown off by a terrific volcanic explosion which was heard for fifteen hundred miles.

The water upon the earth and the air of the atmosphere are very mobile bodies, and perhaps we would naturally expect that they should be constantly thrown into vibration or wave motion.



This looks like the back of some great wriggling reptile. In reality it is nothing more than a harmless stretch of sand ruffled up by the wind. The waves occur with almost unbelievable regularity

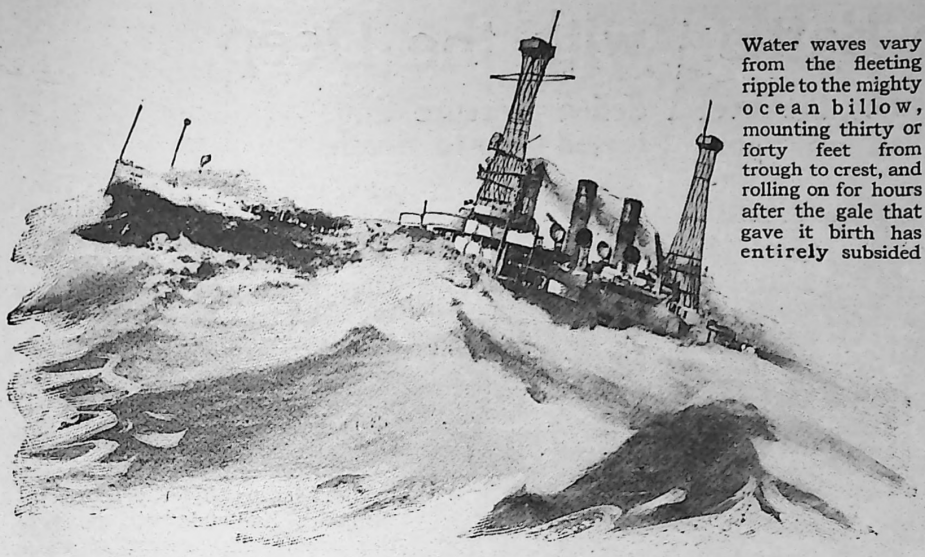
Even the solid earth itself is not exempt, although powerful earth waves are fortunately of rare occurrence in most localities; I say fortunately, because when they do occur they are absolutely the most deadly of all catastrophes in nature. It is estimated that in the earthquake of Messina in 1908 about 100,000 people were killed, while 300,000 are said to have perished in the Indian earthquake of 1737.

While such catastrophic convulsions as these are fortunately rare, minor earth tremors are very common, especially in certain localities. They range from slight but easily perceptible shocks to fine vibrations detected only by delicate instruments, so-called seismographs, constructed especially for this purpose. Even in New York, whose immunity from serious earthquakes is attested with picturesque eloquence by its sky-line of tall buildings, the seismograph of the Museum of Natural History is seldom idle. Probably not a day passes without an earth tremor, such as a delicate seismograph would record, taking place somewhere on our globe. It is hoped that in the course of time the observations gathered with seismographs and by other methods will enable us to foretell the advent of severe earthshocks, and to warn the occupants of the threatened territory.

A Bridge that Was Destroyed by Walking Horses

The subject of vibrations in buildings and other engineering structures is of interest also quite apart from the often only remote possibility of earthquake disturbances. The sway of a tall structure, such as a factory chimney, under the wind may attain an amplitude of several inches. Nor does it necessarily require a large force, such as high wind pressure, to produce very serious oscillations. You know that by properly timed pushes a small child can gradually set into

Even fog comes in waves. You do not see the waves when you are in the midst of it—but if you stand above it on a mountain-peak, the top of the fog will look like a rippling ocean. There are waves in water, in air, in the solid earth, and in the ether space between the stars



Water waves vary from the fleeting ripple to the mighty ocean billow, mounting thirty or forty feet from trough to crest, and rolling on for hours after the gale that gave it birth has entirely subsided

motion a swing with an adult sitting in it. This is a typical example of what is called resonance. The swing has a certain natural period of vibration, just like the pendulum of a clock, which makes one, two, or more beats every second, according to its length and the construction of the clock.

Now, this is a perfectly general property of bodies or systems capable of vibration—that they have a definite period of oscillation, depending on their dimensions, and that, if the proper kind of force is applied at regular intervals corresponding with their natural period of vibration, even a small force is capable of producing very powerful effects. This is the reason why troops marching over a bridge are always ordered to break step. Were they to march in unison it might happen that their footsteps kept time with one of the natural periods of vibration of the bridge or some of its members. Serious results might then follow. A suspension bridge at Manchester, England, many years ago actually collapsed under the hoofs of a troop of cavalry.

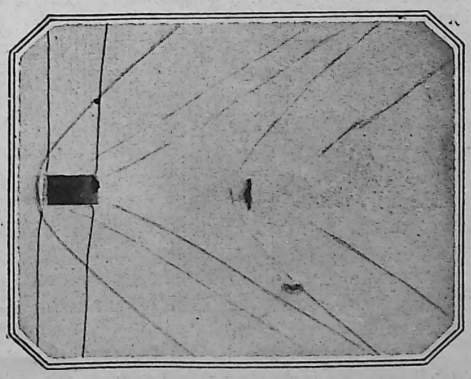
Danger of Oscillation

Similarly, a building may be perfectly safe for ordinary use, and its floors able to support the weight of heavy machinery; yet this same building might be thrown into violent vibrations if its natural period of oscillation should happen to coincide with the rate of revolution of a motor installed within it. The same kind of effect is liable to occur and has to be guarded against in the design of electric installations. If the dimensions of the electric circuit happen to stand in a certain numerical relation, powerful surges are liable to arise, which would either burn out the conducting lines or else break through the insulation; the period of revolution of the dynamo, and hence the frequency of the alternating current, coincides with the natural period of oscillation of the circuit.

Perhaps the most familiar example of resonance, the one after which the phenomenon has been named, is that of a body set into vibration by sound waves striking upon it. If you lift all the dampers off the strings of a piano by pressing down the "loud pedal," and sing any note of the musical scale into the body of the instrument, after the sound of your voice has died out you will hear certain of the strings vibrating and giving out their note, namely those strings one of whose natural periods of vibrations coincides with the note you sang into the piano.

Waves in the water, waves in the air, waves in the earth—there we have at least something tangible. But waves in the empty space between the stars—how can that be? The question is hard to answer. Modern developments seem to indicate that our difficulties in answering it are psychological at least in part. Just as the ear is deaf to sounds outside a certain compass of frequency, so the human mind may be incompetent fully to grasp certain facts and relations of nature. Perhaps the human race will have to recast its conceptions of time and space before it is able to gather into the realm of understanding certain aspects of such phenomena as the journey of light from sun to earth. But this we know: that light does travel through what is for all ordinary purposes empty (airless) space, and, in fact, travels through such empty space with greater ease and at a higher speed than even through the most transparent glass. And we know, further, that in its travel light displays all the characteristics of a wave disturbance; that it travels through space with the perfectly definite velocity of 186,000 miles a second, identically the same as that of the electric waves employed in wireless telegraphy. It is one of the feats of the genius of Clerk Maxwell, that he predicted the existence of these waves on theoretical grounds alone long before they had ever been observed, and that he identified light with them.

The wave lengths of visible radiation, the "light" we see, range from about sixteen one millionths of an inch for violet rays to about thirty one millionths of an inch for red rays.



A brass bullet with a hole through the center was shot from a rifle and photographed in the act. The high velocity of the bullet did not permit much air to pass through the hole, and thus the front air wave does not differ from that of a flat-headed bullet. But the air that did pass through hit the vacuum at the base of the bullet and started a sound wave. The friction of the air along the sides of the bullet is seen

Where the Eye Fails

Just as there are sounds too "high" and too "low" for the human ear to perceive, so there is light "too violet" and "too red" for the eye to see. But the photographic plate still detects ultra-violet rays with a wave length of about four one millionths of an inch. On the other hand, though a body may not be hot enough to give out visible radiation (as at red or white heat), it may still be emitting "heat rays" perceptible to the hand or observable by means of special instruments. The wave length of these may be taken to extend to about twenty-four ten thousandths of an inch.

Above the ultra-violet waves the scale is continued in X-rays, with a wave length of about two one billionths of an inch. Below the infra-red waves comes a long series of electromagnetic waves produced experimentally and ranging from about one tenth of an inch to many thousands of feet in length.

Lastly, the earth being negatively charged, and revolving around the sun, which probably carries a positive electric charge, must send out an annual wave having the stupendous length of six million million miles!

Ready to Battle with the Deep

Clad in armor, the diver would crush an unprotected man to death

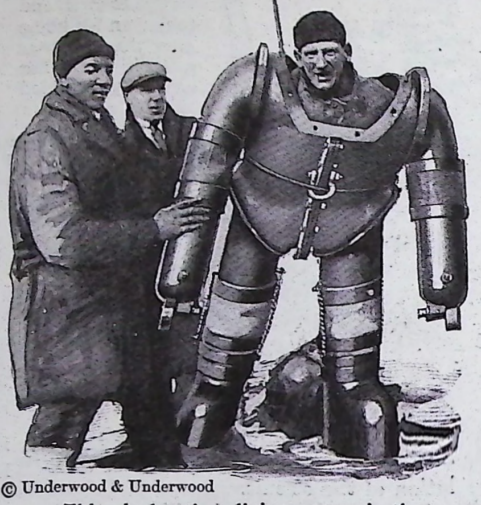
DOWN, down, down, the diver goes after sunken treasure. How deep? Can he reach the *Lusitania*, which lies in more than three hundred feet of water? Not with the present diving apparatus. He would be squeezed into a pulp by the relentless grip of the water.

How deep can a diver go? The record is somewhat more than three hundred feet in sheltered waters. Out in the open sea it would be difficult to descend one hundred feet. The billions of tons of shipping and cargo sunk by the Germans lie in depths of more than one hundred feet. They cannot be reached with the aid of the ordinary diver's dress.

After all, that follows from the very nature of the dress. It is but a combination rubber garment that covers the whole body from the neck down, except the hands, which protrude through elastic cuffs, water-tight at the wrists. To this flexible garment is bolted a windowed helmet to which air is pumped from above. Inflated as it is, the dress is as buoyant as a cockle-shell. To sink the diver like a stone and to keep him upright, the soles of his shoes are weighted, each with sixteen pounds of lead. In addition, eighty pounds of lead are distributed around his body. His equipment weighs about one hundred and seventy pounds. Add to that his own weight of one hundred and fifty, and the total comes to three hundred and twenty-five pounds. He is connected with the surface not only by the air-hose, but by a signal- or life-line in which telephone wires are usually embedded.

Air Within Resists Air Without

Don't suppose that air is pumped into the helmet simply for the diver to breathe. Without the air he could not descend as far as he does. It is the air pressure within the suit that resists the water pressure outside. That intense pressure must be nicely regulated, so that he will not be squeezed to death by the relentless water. The deeper he goes the greater is the pressure of the water and the greater must be the opposing pressure of the air. There is a limit to the air pressure that a man can endure. Hence there is a limit to the depth to which he can descend—about three hundred feet under the most favorable conditions.



© Underwood & Underwood

This elephantine diving armor is the invention of Charles H. Jackson. A descent of three hundred and sixty feet has been made in it. It is said to have all the faults as well as all the merits of its predecessors

But this is not the only limitation imposed by the ordinary diver's dress. A man who has gone down as far as three hundred feet may not be hauled up quickly like a fish at the end of a line. The pressure of the air has forced nitrogen into his blood; for nitrogen constitutes about 80 per cent. of the air we breathe. That nitrogen must be released very gradually. The man's blood-vessels are like a corked bottle of soda-water. You know what happens when the cork is suddenly removed; you know that bubbles shoot up.

So it is with the diver. The nitrogen in his blood would bubble off if he were quickly pulled up. The result might be instant death—certainly suffering and a case of the disease that has come to be known as the "bends." The longer he stays below, the more highly charged with nitrogen does his blood become, and the longer must be the time allowed for him to rise. If he has been working for an hour at a depth of two hundred feet it would take four hours to haul him up. Only by such tedious "decompression" is diving made a safe calling.

These being the limitations of the ordinary diver's dress, why not construct a metal suit, a rigid suit of plate mail, so strong that it would in itself resist the crushing force of water beyond three hundred feet? Let the man breathe air in ordinary atmospheric pressure,—the kind that you are breathing now,—no matter what his depth may be. Wouldn't that solve the problem? Wouldn't that enable him to come up to the surface at once without fear of having his blood boil in the effort to rid himself of its nitrogen? Wouldn't that make it possible to go down five hundred, six hundred, even one thousand feet, and reach hulks that seem now hopelessly inaccessible?

A Negro Mechanic's Invention

Long before Germany began to sink ships by the score, inventors had tried to realize this idea. The latest of these is Charles H. Jackson, a negro mechanic. A descent of three hundred and sixty feet has actually been made with his suit. Will it mean a fortune to its inventor, and the recovery of untold wealth that now lies at the bottom of the sea?

Anyone who is familiar with the past history of diving armor will tell you that there is little originality in Jackson's suit. It has all the faults and all the merits of its predecessors. Encased in such a rigid shell, a man cannot climb down a ladder, seize a rope, and lower himself, after the traditional manner of divers. A derrick must actually pick him up and drop him overboard. Jackson's suit, for example, weighs four hundred pounds, and that is light compared with others that have been experimented with. Depths of even six hundred feet have been attained with similar armor. No difficulty in breathing is experienced. But the man within the steel shell has no freedom of movement. He looks like some elephantine creature from another world. He moves about clumsily. His arms are encased in steel, and so are his hands. They must be so protected; for the terrific pressure of the water would crush his fingers into a shapeless mass. Hence, Jackson, like other inventors, employs an artificial hand—a mechanically operated iron claw.

Salvage experts reject all these diving suits—reject them because the joints leak at moderate depths and become tight only when the great water pressure at three hundred feet or more compresses them. Indeed, some inventors actually install automatic pumps in the suit to remove the water that seeps in. The most that can be expected of a man in such a cumbrous apparatus is to locate a wreck and possibly to guide an electric lifting magnet to steel billets or a clam-shell bucket to a pile of loose cargo.

© Underwood & Underwood

As Helpless as a Fish Out of Water

Untold riches lie in the depths. Can the diver reach them? All depends on the armor. For this modern knight, if he is to secure the treasure, must meet and conquer the dragon of the great depths—crushing, deadly water pressure. That is why he is clad in steel armor so heavy that a derrick is needed to lift him from the deck of the ship and lower him over the side. If he were clad in the ordinary diving dress it would be necessary to fight back the killing pressure of the water by opposing to it the pressure of air forced into the suit by powerful pumps. But there is a limit to the amount of air pressure a man can endure: that limit is approximately the pressure required to fight back the water at a depth of three hundred feet. If men are to explore the greater deeps they must go down clad in armor in itself strong enough to defy the tremendous water pressure, leaving the diver free to breathe air at ordinary surface pressure while he works. Such a suit, the one shown in the reproduction of a photograph above, has been invented by a negro mechanic. A descent of three hundred and sixty feet has actually been made with it.

The diver is ready to adventure in the deeps. The heavy armor will save him from the crushing pressure of the water, but can he do useful salvage work encumbered by this shell of steel?

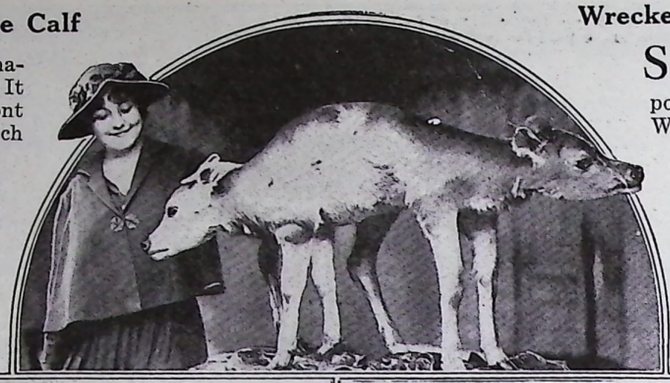
The Life Story of a Double Calf

A MOST curious freak of nature is this double calf. It has two heads, two pairs of front legs, and two bodies that join each other in an almost straight line. One pair of hind legs jut out from the point where the two bodies meet.

The calf lived and thrived for six months, but then it caught cold and died. The two perfect heads were quite independent of each other. The calf could eat with one or both at the same time, to suit itself.

It was born on a farm near Dayton, Ohio, and its parents were Jerseys. Although it was cared for most tenderly during its six months of life, it grew but little during that period.

As the lady above patted one of its heads, we wonder if the other head was jealous.



Wrecked Aviators Need Not Drown

SUPPOSE that your airship engine stalls over water. Suppose that the hydrogen is depleted. What then? The answer is to be found in a novel life-boat constructed of waterproof fabric, and designed to be inflated by the air-pumps which keep the envelope of a "blimp" rigid in spite of changes in gas volume. On ships of the Zeppelin type such as the R-34 the device is blown up by other means.

When inflated the airship life-boat will support six people until a rescue vessel summoned by the wireless of the wrecked airship comes to the rescue.

Our illustration gives an excellent idea of its general characteristics, though in this case the air-pumps are replaced by a much more attractive kind of inflater.

You Can Have Your Own Gasoline Station

AN automobile owner at Redondo Beach, Cal., became very tired of driving his car around to the garage every little while in order to replenish it with gasoline. Accordingly he had a tank built into the wall at the side of his driveway. You can see it in the above picture.

The tank is of metal, covered with cement. A connection is provided for filling and a float gage shows the amount of gasoline in the tank. To draw off the contents a small pump is used.

The owner has an arrangement with the gasoline distributors to keep the tank filled, and so he has a constant supply.

A Carving of General Pershing Made Out of Soap

THEY'VE photographed General Pershing, made busts of him, painted pictures of him, and now one man has carved his head out of soap!

This may seem queer to you, but if you were a soap salesman, or in fact any other kind of salesman, you would realize the value gained by decorating your product with a likeness of the hero of the hour.

The man who ordered the soap bust of Pershing was a druggist who, like most druggists, sold everything else besides drugs. He filled one window of his store with cakes of soap, placed the soap bust of Pershing in front, and thereby greatly increased his sales.

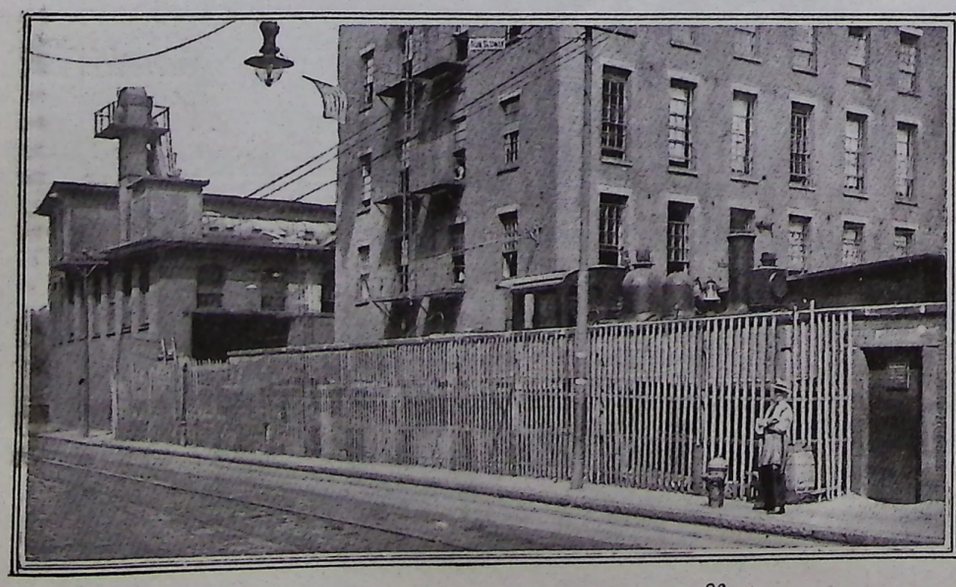
A Fence that Was Founded in Barrels

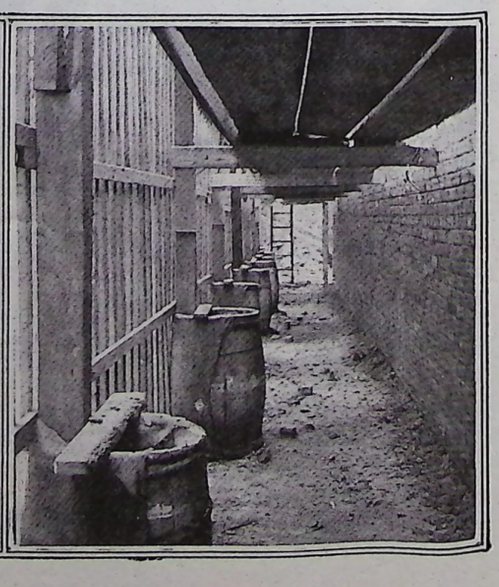
"WELL, I hate to take up all those paving-stones, and we certainly can't break through them to make post holes," said the boss, when he and the foreman were discussing the erection of a temporary fence over a portion of a sidewalk.

"M-m, no," replied the foreman; "but wait, I've got an idea: why not put the posts in barrels and then fill the barrels with something?"

Accordingly the posts that were to support the fence—and a scaffolding later on—were placed in large tubs which were set out at equal distances along the line of the proposed fence. Ashes were brought from the boiler-room of the factory and the barrels were filled up, holding the posts firmly in place.

When a high slat fence was built on the posts in the ordinary way it afforded perfect protection against intruders. How it looked, inside and out, when it was finished you can see by a glance at the picture.

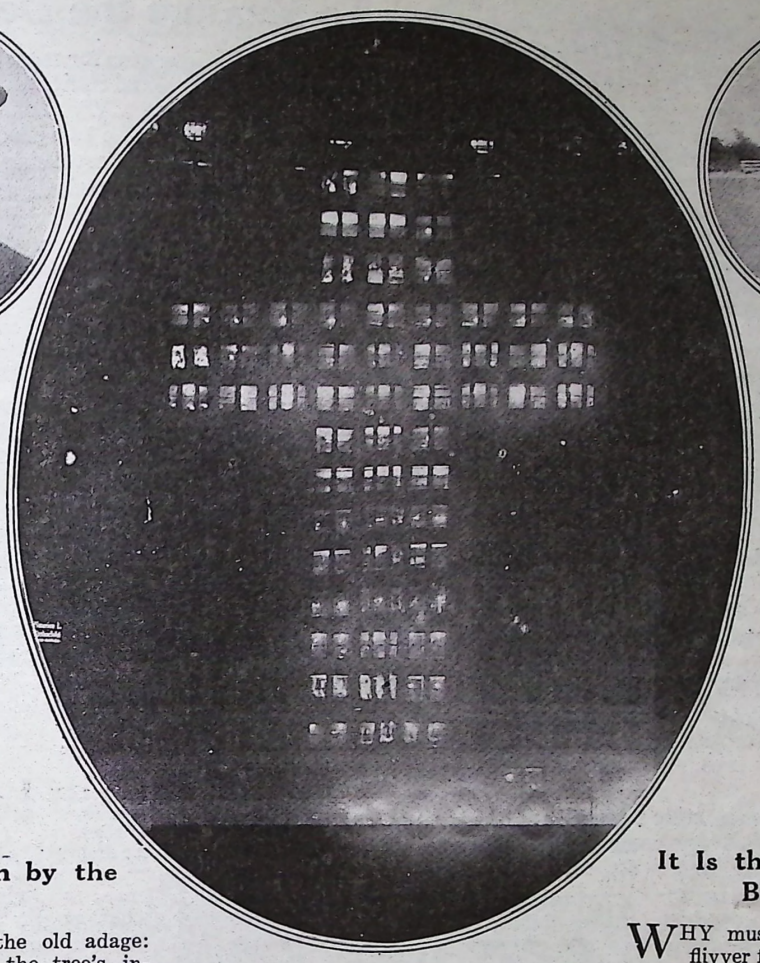




Billiards on a Cigar-Holder

WHEN Mr. Asra, a famous German billiard-player, gets through with the cigar-holder he is using it will undoubtedly find its way into the museum for freak works of art where the gem of the collection is a copy of the Venus de Milo with a clock in her abdomen.

The cigar-holder is six inches long and on it is mounted a small ivory billiard-table at which two men are playing.



A Building Lit Up in the Shape of a Cross

SHOULD you approach the Railway Exchange Building in Chicago on a dark and gloomy night, don't be alarmed if you see from a distance a great brilliant cross standing out in front of the building. As you draw near you will see that it is simply the effect of certain lighted rooms against the dark background of the building.

Many of the large office buildings in the Loop district of Chicago have gone in for this artistic illumination. They choose their designs and then light up the rooms necessary for making them.

Perhaps it was this very extravagance at a time when coal was scarce and threatened to be scarcer that led to restriction in the use of electric light in Chicago. The street lamps were darkened and the office hours were shortened in order to save coal.

Drinking at the Fire Hydrant

THE fire hydrants in the town of Torrance, Cal., have great white porcelain bowls erected on their tops. And when there are no fires in town the natives gather around these pumps and drink. For the bowls are regular drinking bowls into which a constant flow of water is forced.

To install one, a hole is drilled in the top of the cap of the hydrant and a one-inch pipe is connected with the water-pipe below.

Bent But Not Broken by the Wild Wind

HERE is new proof of the old adage: "As the twig is bent the tree's inclined."

Instead of growing straight upward the tree shown in the picture below grew horizontally after the trunk had attained a height of four feet. The reason for its L formation is the wind.

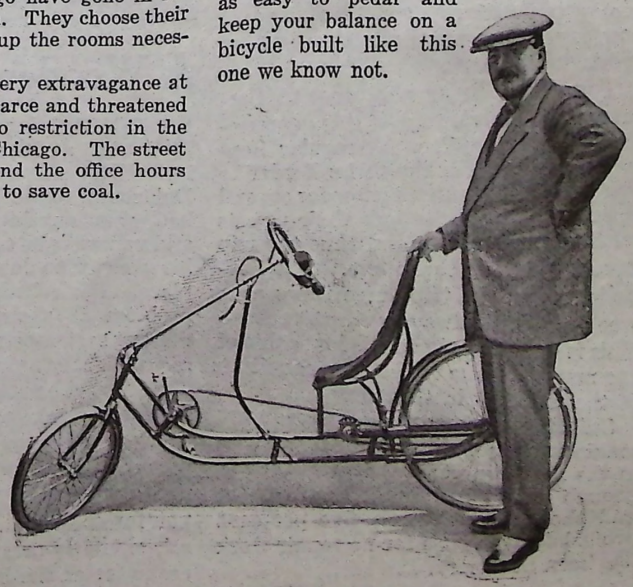
This tree is situated on an exposed part of a cliff in the Isle of Thanet, England. Ever since it started to grow the sea wind has blown on it from one direction. The tree was not strong enough to stand up against this constant force and so it bent over. In spite of this, the leaves are all doing well, nevertheless.

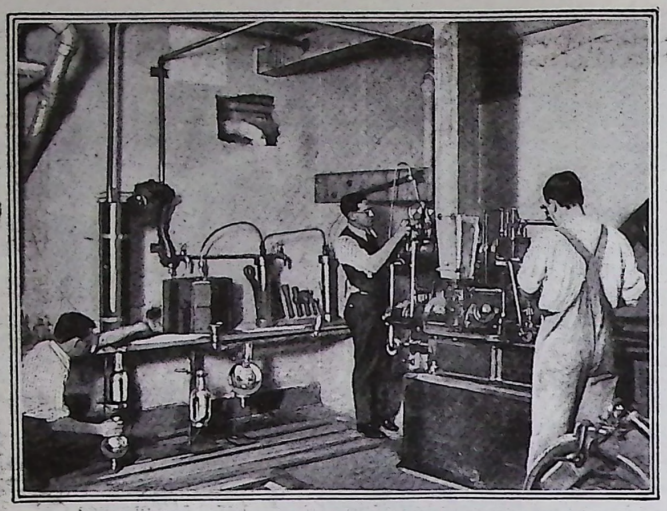
It often happens that plants and trees incline toward the light when they are located in dark places, but it is seldom that a tree bends over so completely because of the wind.

It Is the Limousine of the Bicycle World

WHY must a cyclist sit up straight, flivver fashion, when he rides? An uncomfortable Parisian cyclist asked himself this question, and answered it by building the bicycle shown below. It contains most of the comforts of an automobile driver's outfit. The seat itself is low and has a supporting back; instead of handle-bars there is a steering wheel with a horn mounted on it. The pedals are not directly below the seat but are up near the front wheel.

This front wheel, by the way, is smaller than the usual bicycle wheel, the reason for this being to make room for the long sloping steering wheel. Whether it is just as easy to pedal and keep your balance on a bicycle built like this one we know not.





At the right, compressing air; in the center, admitting it to the cooling tubes; at the left, drawing off liquid air

Making Liquid Air

AIR is invisible, says Webster's dictionary. Not always. Air can be turned into a liquid, whereupon it becomes quite visible. First, the air is compressed to three thousand pounds per square inch, which is about two hundred times as great as ordinary atmospheric pressure. Then it is cooled off in tubes until its temperature reaches three hundred and ten degrees, Fahrenheit, below zero. At this point it becomes a liquid.

Liquid air is used both in scientific research and in industry. In research work it is used for cooling; the substance is immersed in the liquid air and watched to see how it acts at low temperature. In industry liquid air is used to produce pure oxygen. Air is composed chiefly of oxygen and nitrogen, and owing to the different boiling points when liquefied they can be separated.

The Price of a Zeppelin Ride

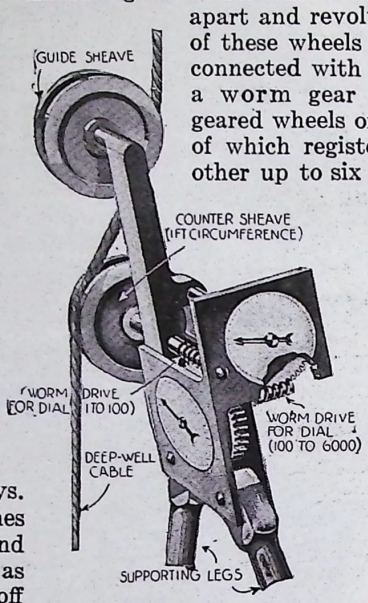
THE value of the German mark sinks lower and lower. You can buy about forty of them for an American dollar now. Thus should you buy a dollar's worth and go to Germany, they would be worth nearly ten dollars over there, and you could buy ten dollars' worth of goods with them.

The Swiss, living next door to Germany, take advantage of this depreciation in mark value. A regular Zeppelin service from the Swiss border to Berlin has been running now for several months. The Swiss buy their tickets with German marks and thus the trip becomes a very cheap one. The Zeppelin makes the trip three times each week and it is always well patronized. This is due not only to the low value of the mark but also to the poor condition of the railways in Germany today.

Still, the owners of the Zeppelin are making money by it. They figure that in the first two years they will take in enough money to pay for the Zeppelin and then have a twenty-five per cent profit left over. So far no repair work has been necessary.

To Measure the Depth of a Well

AN ingenious apparatus for measuring the depth of wells or mine shafts is a dial indicator actuated by a worm gear, the invention of Charles A. Wilkins of Bradford, Pa. This measuring device contains two grooved wheels several inches apart and revolving in the same plane. One of these wheels is an idler, while the other is connected with the measuring mechanism by a worm gear which sets in motion the geared wheels of the two indicating dials, one of which registers up to one hundred, the other up to six thousand feet.



Place the grooved wheels against the cable, let the cable run up or down as far as it will go, and read off the distance on the dial

The rope or cable is placed against the two grooved wheels in the manner shown in the picture, so that it is pressed with considerable force against the lower wheel. As the cable moves up or down it makes the wheels go round. The rotations of the measuring wheel are communicated to the indicator, which shows with great accuracy the number of feet of rope or cable which have passed over the wheels.

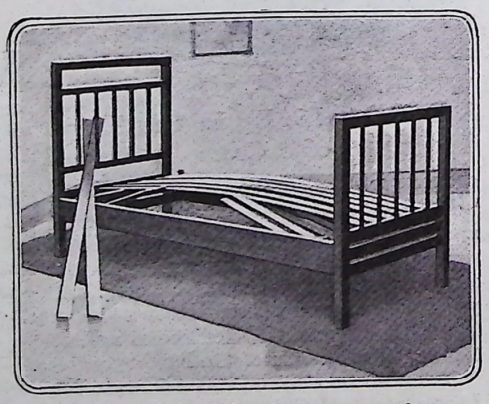
Look Out, Below!

A SHARP blow on the back of the head with a heavy lead pipe—that ought to knock out anyone no matter how thick-skulled he may be; and yet the man in the picture below doesn't seem to mind it in the least.

Why not? He wears a shock-absorbing cap sufficiently thick and resilient to absorb most of the force of the blow. It has many air holes, so that the hair of the wearer is well ventilated.

The cap was not designed for men who walk down lonesome alleys on dark nights, but for miners, builders, tunnel-diggers, and others who are constantly in danger of having something heavy dropped on their heads.

The shock-absorbing cushion is circular in form and fits inside the cap.



To a wounded soldier there was comfort in the idea of a bed that wouldn't sag

A Wooden Bed-Spring

WHILE lying wounded in a hospital, a French soldier named Delacourt found that his bed was developing hills and valleys from supporting his weight so long in one place. His solution of the problem is shown above.

Long springy slats are inserted tightly between head and foot boards, arching upward from the ends, every slat above having a companion slat below arching downward so that each pair forms an oval. A second set, similarly arranged, run crosswise of the bed-frame.

A blow on the head with a lead pipe usually means trouble, but in this case it simply proves the excellence of a shock-absorbing cap

Learning to Walk All Over Again

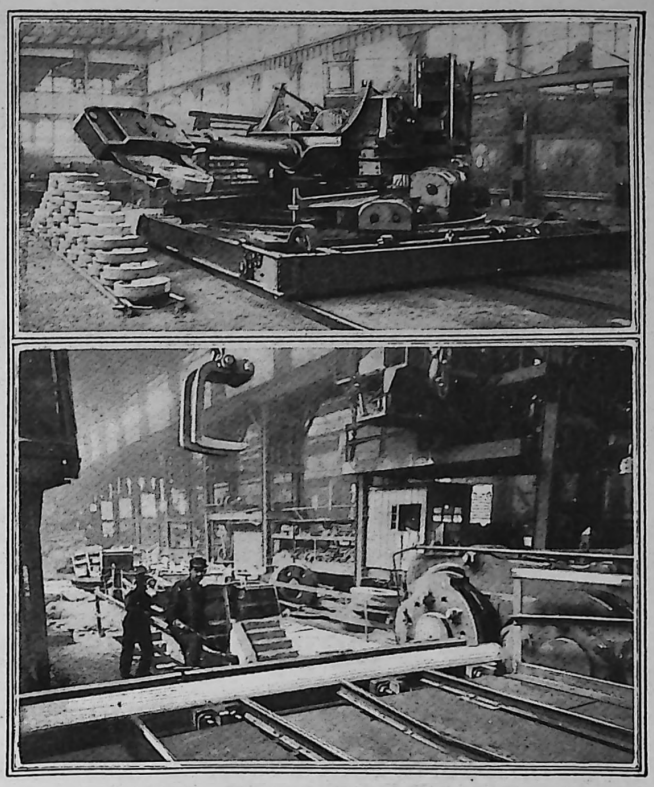
AFTER a long illness a patient usually has to learn to walk all over again.

How is this best done? Formerly the convalescent leaned on his doctors and nurses; but doctors and nurses are scarce in these days and their time should not be wasted in this fashion.

He's learning to walk for the second time; when he gets tired he can pull out the seat and sit down

Here is a chair that has been invented for the purpose of teaching grown-ups to walk. The seat is mounted on the white iron frame so that the patient may push it out of the way when he wishes to walk. He then grips the upper rails for support.

The chair moves on broad-flanged rollers, making it possible for the convalescent to push it around the room with very little effort or danger of fatigue.



A pair of giant tongs picks up the finished wheels, as shown in the upper picture, and stacks them for shipment. In the lower picture blank car wheels are being sliced from a red-hot cylinder of steel by powerful rotary shears

Helping the Blind to "See" Color

FINGER-TIPS are the eyes of the blind. They cannot "see" beyond the reach of the hand, and notwithstanding the best of training can get impressions only of size, form, and surface texture, but never of color, distance, and perspective.

The invention of printing books with raised letters was a great blessing for the unfortunate thousands deprived of sight. The invention of the dot alphabet by Braille and its later improvement were of material help in making the storehouse of human knowledge accessible to the blind. Libraries were established and made available for their use where they could find books on various scientific subjects, on history, literature, and music, books of poetry, fiction, and travel.

And recently, under the stimulus of his sympathy for the thousands of soldiers who have become blind during the great war, Fried Stern, a German artist living at Frankfurt, has invented a method for conveying color impressions to the blind through their sense of touch. The pictures below illustrate the method employed. They are printed in relief on heavy paper and the colors are indicated by giving the surfaces different texture. These differences are produced by a system of lines, dots, crosses, etc. Each pattern represents a certain color as explained in the key which accompanies each picture.

This shows a German artist's idea of making color "visible" to the blind. The color is made palpable by its peculiar texture as indicated by the key

Slicing Off Steel Car Wheels

THE next time you cut a slice of bread, think of car wheels made of steel.

Why? Because in some factories wheels are sliced from a great round steel bar just as if it were a loaf of bread.

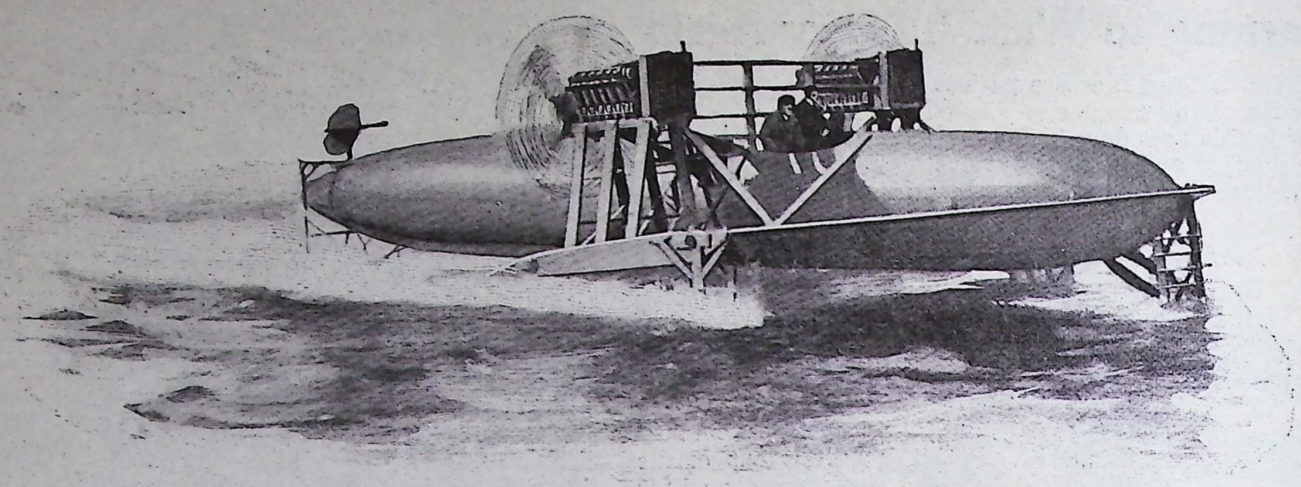
The first step in this new process is to roll a steel ingot into cylindrical shape, the cylinder having a diameter slightly less than the diameter of the wheel to be made. While the ingot is still hot the wheels are cut off to the proper thickness by a pair of powerful rotary shears.

The blank wheels are then heated, further, in a furnace; when hot, holes are punched through the centers, after which the wheels are fed one by one to a mill. Here they are whipped into shape by a pair of dies that are actuated by a hydraulic press.

The edges are trimmed off by shears and the wheel is finished. A giant pair of tongs seizes the finished wheels and stacks them up in piles on the floor.

The entire operation is completed in less than a minute and it takes but one attendant to work the machinery.

Owing to the continual growth in size of both freight and passenger cars, there is little doubt that the steel wheel is gradually supplanting wheels made of cast iron.



When at rest the HD-4 is supported by the hull and two outrigger hulls or pontoons connected with the main hull by means of a deck shaped like the wing of an airplane, and therefore made to work its passage. Steering is accomplished by turning the tail set of hydrofoils on a vertical axle

Seventy Miles an Hour on Water

By William Washburn Nutting

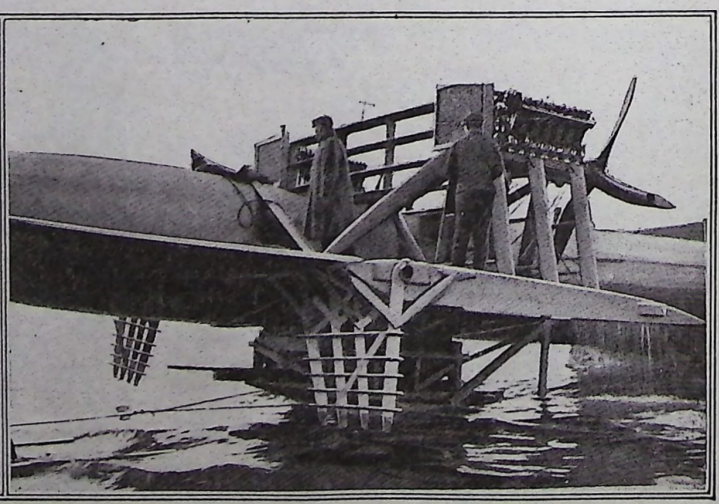
A STRANGE new craft, unlike anything thus far developed for air or water navigation, made its appearance recently on the Bras d'Or Lakes, Nova Scotia, where Dr. Graham Bell, inventor of the telephone, has his laboratories. The new glider, which has been startling the natives of Baddeck by tearing about the lake at the rate of seventy miles an hour, was developed from a series of experiments conducted by Mr. F. W. Baldwin and Dr. Bell during the past ten years. She is the fourth full-sized hydrodrome to be built. Hence the name—HD-4.

The new craft is not a seaplane; neither is she a hydroplane in the usual sense of the term. She is the successful application of the principle of dodging the resistance of the water by lifting the hull clear of it on a system of planes not a part of the hull itself. Many have been the attempts to work out a successful application of the idea on paper, as the patent office records will show. Cooper Hewitt and the Italian Forlanini both attained a degree of success with gliding craft using superposed planes several years ago. But the HD-4 is the first really successful embodiment of the idea.

At high speed the hull of the craft is entirely clear of the water, and is supported on small steel planes arranged in groups like the shutters of a Venetian blind. There are three of these sets, one on each side forward and one at the stern, giving a three-point support like that of an iceboat. A fourth set at the bow, called the "preventer" set, is used merely to assist the hull in climbing out when getting under way, and to prevent the bow from diving when traveling in rough water.

The faster the boat goes, the higher she rises from the water, so that she automatically reduces or reefs the submerged hydrofoil surface to just the amount required to carry the load. This reefing principle is one of the important features of the HD-4. Some day it may be applied to an airplane to reduce the wing area when traveling at full speed and hence increase efficiency.

In spite of the fact that the HD-4 weighs more than ten thousand pounds, she is supported on less than four square feet of submerged hydrofoil surface when at sixty knots, which means that every square foot is lifting more than two thousand pounds. When you consider the fact that an airplane wing supports about ten pounds to the square foot, this seems unbelievable, until you remember that the areas of the supporting surfaces are in inverse proportion to the specific gravities of the mediums in which they act. Salt water is nearly eight hundred times as heavy as air, which explains the fact that the hydrofoil surface need be but $\frac{1}{800}$ of the area of the wings of an airplane to support the same load.



© International Film Service

The gentleman who looks like Santa Claus is Alexander Graham Bell, the inventor of the telephone. He has now devised a boat which lifts itself out of the water just as an airplane lifts itself up off the ground

She is not a seaplane, and not a hydroplane. She dodges the resistance of the water by lifting herself clear of it on a system of planes not a part of the hull itself. Her speed is seventy miles an hour. The HD-4 is sixty feet long

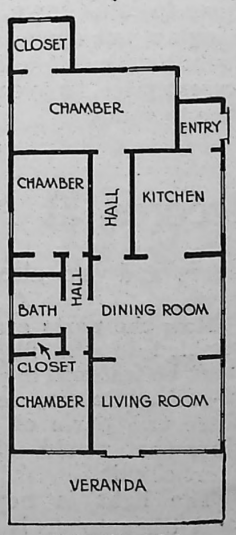
What the Handy Man Can Do with an Old House

By George M. Petersen

This article is published with the idea of offering assistance to those of our readers who want to keep their property up-to-date. Any questions that may arise in the reader's mind will cheerfully be answered by the author free of charge, if a letter is forwarded care of the POPULAR SCIENCE MONTHLY *with a stamped envelope enclosed for reply.*—EDITOR.

IT is undoubtedly true that many American houses are as the first occupants left them, because the owners are living in the hope that some day in the dim future they may be able to build a bigger and better one, and are consequently loath to expend any money on remodeling the one they now have. This is a mistaken and foolish idea for various reasons. The old home can be remodeled satisfactorily without any great expenditure and will last for many years to come.

It is, therefore, with the idea of being of some real assistance to our readers who are progressive enough to want to keep their property up-to-date that we are publishing this article on remodeling.



SOLUTION NO.4

Here the front part of the house has been altered, so that the two side chambers are greatly enlarged

The style of house that we have chosen for consideration is the old-fashioned one-story cottage, which is just as it was fifty years ago with the exception that the outhouse has been abolished and a toilet installed in a closet off of the kitchen. Of course this was really an improvement in some respects, but hardly one which can be considered to be really up-to-the-minute from a sanitary point of view. The plan with which we shall work is shown in the drawing captioned Original Plan (page 92).

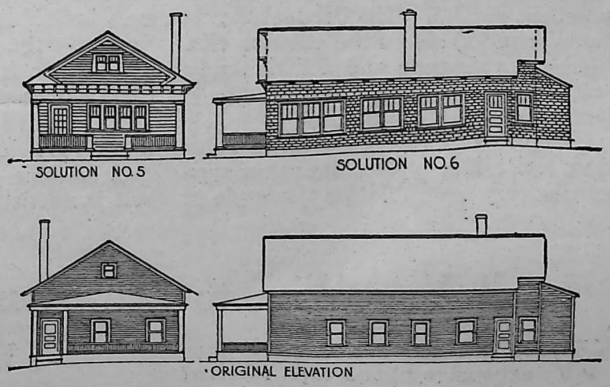
It will be noted that aside from the rather poor arrangement of rooms the rooms themselves are poorly lighted, a common fault with the typical old house of this type. In this regard it may be well to mention that no matter what else you do when remodeling your house do not fail to get sufficient light and ventilation.

In Solution No. 1 we have modernized the house, to a certain extent at least, by merely moving the old pantry partitions and building in a bath-room which is easily reached from either of the two bedrooms. Although this step does not appear to be very drastic it is really very important, as for very small expense the property has been made fully one hundred per cent more desirable.

Solution No 2 has proceeded another step in the right direction and the partition between the reception hall and parlor has been removed so that a large modern living-room has been obtained. This move is especially desirable because it gives one the impression that the house is an up-to-date bungalow instead of an old house remodeled. The back parlor has given way to the dining-room, while the old dining-room has been partitioned off into a hall and office. This is really an excellent solution of the problem which confronts so many persons today—how to have an office right in the home which will look businesslike without going to excessive expense.

Solution No. 3 has gone another step in the right direction and brought the kitchen location into juxtaposition with the dining-room. This latter room has been made a trifle narrower and a little longer in order that clothes closets, linen closet, and hall may be incorporated into the scheme. Here, again, the young professional or business man may have his office without in any way interfering with the home section of the house. If an office is not required the room may be used as a den, or it will make another excellent bed-room so that the house will then possess three chambers.

Solution No. 4 leaves the entire rear part of the house just as it was in Solution No. 3, but the front part has been altered so that the two side chambers are greatly enlarged. Of course the living-room suffered a little in size as the result of this move, but this fault, if it may be so termed, is readily overcome by the legitimate use of a large-cased opening between the living-room and the dining-room, which allows them to be thrown together as practically one room if a large party is expected.

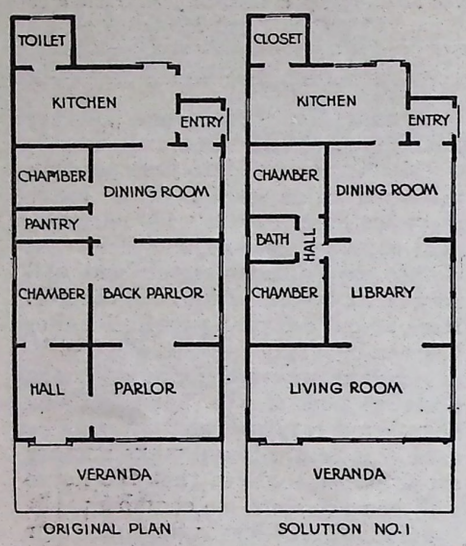


Above, the house covered with narrow siding; below, the same house covered with shingles

This is the same idea as the one shown in Solution No. 3. One may consider the living-room and dining-room as two rooms, though in reality they are only one. In this instance the idea was to convert the space across the front of the house into a music-room and a living-room by just showing the suggestion of a partition between them. This cased opening problem is worthy of considerable thought upon the part of the owner, as it is often easier to furnish two rooms than it is to furnish one large one.

Of course, any of these plans or

solutions may be carried further by the addition of a fireplace in the living- or dining-rooms. Hardwood floors throughout the house, built-in bookcases, china cabinets, kitchen dressers, linen closets, and many other features of a like nature will greatly add to the beauty and comfort of your remodeled house, but such things are not actually essential and may be put in at any time without any great additional expense.



Remove the old pantry partitions and build in a bath-room opening conveniently into the two bedrooms

Of course the remodeling need not end with the interior, but may be continued to the exterior as well with excellent results. The Original Elevation (page 91) shows the exterior of a house of this type and a little study will convince anyone how readily it lends itself to modern ideas.

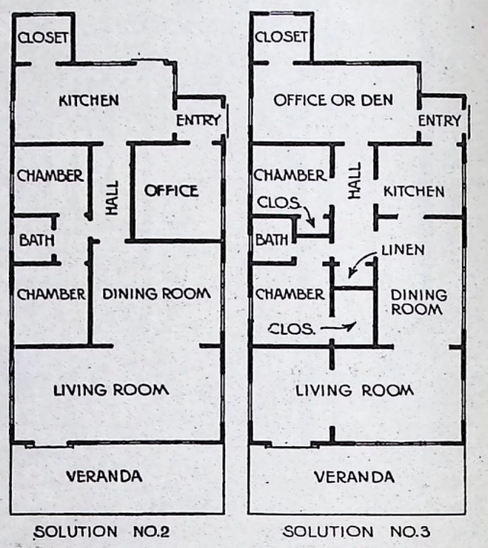
The front elevation shown in Solution No. 5 is a typical bungalow type and is very desirable for this style of house. This alteration is especially adapted to the plan shown in Solution No. 2, although it would look well with almost any window layout. The plain gable cornice has been replaced by a very wide barge board and heavy moldings, and the main cornice has been carried across the front of the house. This cornice is supported by medium weight brackets and the whole tendency of the elevation is to make the building appear heavy, solid and massive.

The small balusters shown in the veranda rail on the old elevation have been replaced with one and three quarter inch square pickets which are placed between heavy top and bottom rails. The veranda columns and newels are slightly tapered, instead of being perfectly straight as in the old elevation and the pitch of the roof has been altered so that it is now sloped toward the front of the house to allow for the cornice return across the front of the building.

The small window in Solution No. 5 also helps to set off the house, but casement windows are not recommended by the writer. Use double hung or check sash windows, as they are commonly termed, and reduce the size of the glass in order to get them into a given opening rather than install the larger glass and a casement sash.

The main reason for this statement is the fact that it is almost impossible to make casement windows tight unless a comparatively large amount of money is expended upon each individual window for patented weather-strip, and then the results are usually far from satisfactory. It is therefore best to stick to the double hung windows and cut the upper sash into three lights as shown in the drawings or some other design which will suit the artistic ideas of the owner.

The side elevation shown in Solution No. 6 is of the same house covered with shingles, instead of the old narrow siding, and was designed to work with the plan shown in Solution No. 4. This side elevation allows a great quantity of light and ventilation in the house and, as has already been mentioned, too much of either of these items cannot be obtained. In this elevation the gable is shown supported on five heavy brackets, while the main roof cornice is blocked up on lookouts.



By a little planning, the reception hall and parlor may be transformed into a large living-room

It is certainly a fact that building materials are high priced at present but that is all the more reason why people should do their building and remodeling now instead of waiting for prices to come down, as all material is going up, not down, and there is little doubt but that it will remain up at its present price, or even higher, for some time to come.

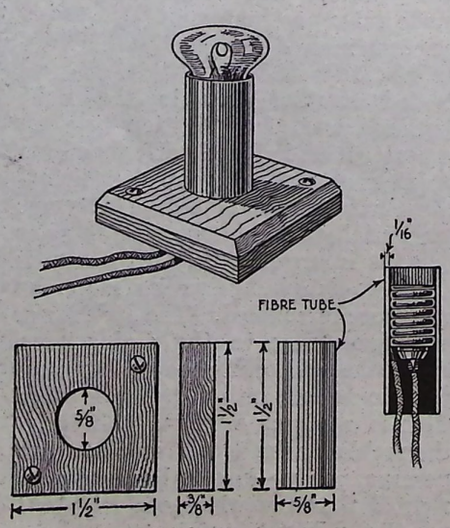
If You Wish to See Your Phonograph Records at Night

By H. E. Mende

WHY scratch and damage your expensive phonograph records? You can install a miniature electric light in a very few minutes, so placed that it will illuminate the record while at the same time leaving the room in darkness.

Obtain a piece of hardwood and cut a piece from it 3/8 by 1½ by 1½ in. Drill a hole in the center 5/8 in. in diameter, also two small holes in each side, to be used for screwing it to the motor-board; then bevel the edges. Now get a piece of fiber tubing 5/8 in. in diameter with 1/16 in. wall and 1½ in. long. This piece is to be glued into the 5/8-in. hole in the center of the base.

Purchase a keyless receptacle for the miniature screw base bulb, and break loose the cement to take out the brass threaded sleeve and the bottom screw; then solder a piece of thin insulated wire to the brass thread sleeve and one also to the bottom screw.

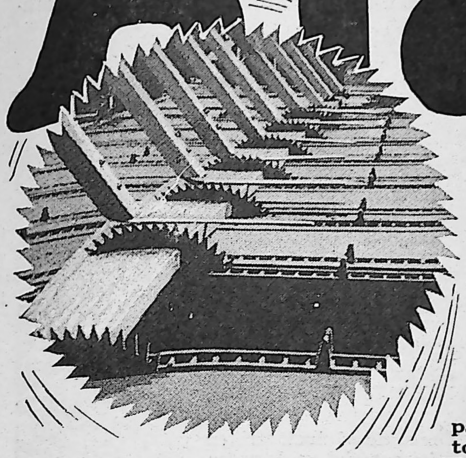


This illustration shows the entire mechanism before and after assembling

Now the parts are ready to be assembled in the fiber tubing, which must be fastened in place with plaster-of-paris. Be very careful not to have these two parts of the wires touch, since that would, of course, cause a short circuit.

The light is now finished. The next thing to do is to determine the best place to install the light, where it will not interfere with the working parts of the phonograph. When this is settled, drill a 1/8-in. hole through the motor-board, and screw the light in position. Place the batteries in the bottom of the machine and connect the wires.

The correct bulb for one battery is 1.5 volts. The bulb takes the place of a switch, which lights when it is screwed down and goes out when it is loosened.



Aladdin

Readi-Cut Homes

Cut Building Costs

Lumber shortage—a virtual famine of lumber—exists in many parts of the country. Reports indicate it is impossible even now to get material for certain needs. Stocks were never as low as they are now. The demand was never as great as it is now. THIS MEANS STILL HIGHER LUMBER PRICES. It means that prices will go upward rapidly—that it will possibly take $150 in six months or a year to buy $100 worth of lumber at present prices.

The System

Complete Material for Immediate Shipment

Aladdin taps the four greatest forests of the United States. Each one has sufficient standing timber to take care of the needs of the country for many years. The probable lumber famine predicted in all parts of the country will not affect the Aladdin Co.

Every Aladdin house ordered in 1920 will be shipped quickly and *completely*. Sufficient lath and plaster for lining the interior of the home. Nails in necessary sizes and quantities. Beautiful grain, perfect quality interior trim. Doors of high quality material and excellent workmanship. Every item of the complete home will be promptly shipped to every Aladdin purchaser in 1920, regardless of shortage of lumber and other building materials in the general markets.

National Homebuilding Service

Shipments of Aladdin Readi-cut Homes are made from the four greatest timber-producing sections in the United States. From the Atlantic to the Pacific—from Canada to the Gulf—Aladdin can serve you wherever you live. Aladdin houses are manufactured and shipped direct from the Aladdin Company's own mills in Michigan, Mississippi, North Carolina and Oregon. Aladdin houses come to you in a straight line from the nearest timber region. Complete Sales and Business Offices are maintained in connection with each mill. Fully 24 hours time is saved in your mail reaching our offices.

20 ft. of Lumber from a 16 ft. Board

The Aladdin System of Homebuilding has been practicing for 14 years the principle the world has only learned during the war—the elimination of waste of lumber and labor. The Aladdin Book explains this system thoroughly, shows how 20 feet of lumber is cut from a 16 ft. board. The great Aladdin Organization, composed of experts in every branch of homebuilding, stands ready to help you build your home at a saving. Put this group of experts to work on your problem.

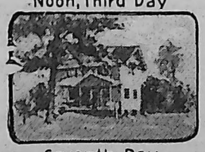
Send for Interesting Book "Aladdin Homes"

The Aladdin Book of Homes has a message for you. Amongst its pages, profusely illustrated in colors, leading home designs are represented to you. Aladdin houses are cut-to-fit as follows: Lumber, millwork, flooring, outside and inside finish, doors, windows, shingles, lath and plaster, hardware, locks, nails, paints, varnishes. The material is shipped to you in a sealed box-car, complete, ready to erect. Safe arrival of the complete material in perfect condition is guaranteed. Send today for a copy of the book, "Aladdin Homes," No. 1372.

The Result

First Day's Work

Noon, Third Day


Seventh Day

Twentieth Day

The Aladdin Co.

Bay City, Mich.

ALADDIN READY CUT HOUSES — Sold By The GOLDEN RULE

Branches Wilmington, North Carolina
Hattiesburg, Mississippi
Portland, Oregon
Toronto, Ontario, Canada

Write to Nearest Offices

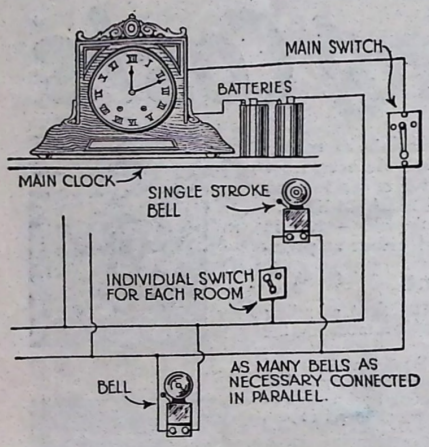
The Aladdin Company
Bay City, Mich.
Enclosed find stamps for the book "Aladdin Homes" No. 1372.

Name _____
Street _____
City _____
State _____

How to Make All the Clocks Strike at Once

By L. B. Robbins

IF you have ever lain awake in the night and listened to several clocks trying to strike in time with each other, with a syncopation which reminded you of a jazz band or an Oriental funeral procession, you will appreciate the following device to eliminate such ragtime and make Father Time walk the straight and narrow path. The idea consists of utilizing the best timekeeper in the house as the central station and electrically transferring the impulse of its strike to bells in the various rooms of the house. In this way the hour is struck by each bell at precisely the instant it is struck



The whole contrivance is operated by the master clock

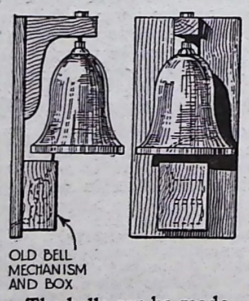
by that of the central clock, and there will be no guesswork as to the time.

The general arrangement is shown in the drawings with such detailed sketches as are necessary to make the operation plain.

The first requisite is a clock that strikes the hour and half hour. The style of striker is immaterial so long as it consists of a lever, pivoted somewhere along its length, one end of which connects with the striker wheel, the opposite end striking the gong. By studying the detailed sketch of the striking apparatus this will be clearly seen. Styles and shapes of levers may vary, but the principle remains the same.

Select a narrow strip of very thin, flexible metal, which will give under the slightest pressure but will return to its original shape when the pressure is removed. If the lever can be conveniently removed from its position in the clock, this piece of spring metal can be soldered to the lever close to the pivot hole. If not it can be clamped to the lever, in this position, with fine wire. The extending end should be doubled under, as shown, to gain greater flexibility. Bend it so that its relation with the side of the clock is about as indicated.

Directly under this spring place a block of wood, fiber, or rubber, into which a screw is inserted. The block serves to insulate the screw from the clock frame or any metal parts. Connect the screw to an insulated binding-post, at a convenient point, with insulated wire. Then bring the head of the screw to within a fraction of an inch of the spring strip. The distance should be adjusted so the strip will come into good contact with the screw when the hammer of the striker is in contact with the gong, but so that there is good clearance between them when the hammer is back at its resting-point.



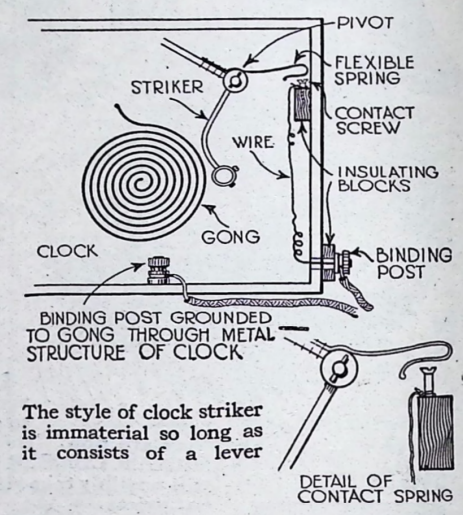
The bells can be made ornamental and the working parts hidden

A second binding-post should then be connected to the metal framework of the clock. Be sure this has metallic connection with the gong.

This completes the alterations to the clock.

Wire the house bells in parallel as shown. Provide each bell with an individual switch, so that it may be cut out if necessary. This, owing to the method of wiring, will not prevent the other bells from striking with the clock. A general switch near the clock serves to cut out the entire system if so desired.

Use bells with a single stroke action.



The style of clock striker is immaterial so long as it consists of a lever

These will give the best results as the time of contact of the gong switch is so brief that it would have little effect upon the vibrators of the bells.

If no single stroke bells can be readily procured common vibrator bells can be changed to single stroke action by disconnecting the wiring from the vibrator adjusting screw, and transferring it directly to the magnet windings by means of the off binding-post. Thus, when the coils are magnetized they pull the armature to them, but release it the instant the current is shut off. The spring at the foot of the armature serves to return the hammer to its former position.

If the builder wishes, he can make brackets to hold small bells of more conventional pattern, and utilize the magnets and equipment of call bells. The working parts can be hidden from sight by neat little boxes built around them. One's own ingenuity will suggest many artistic ways in which these striking bells can be disguised.

Handling Electrical Circuits in Safety

CARELESSNESS in handling electrical circuits is the cause of many fatalities. Electricity may endanger the life or seriously maim the person who works on live wires in a careless manner. Serious results may be the consequence of direct contact, causing burns, severe shock, and, in many cases, instant death. A flash or an arc may endanger the eyesight, besides being the cause of severe burns.

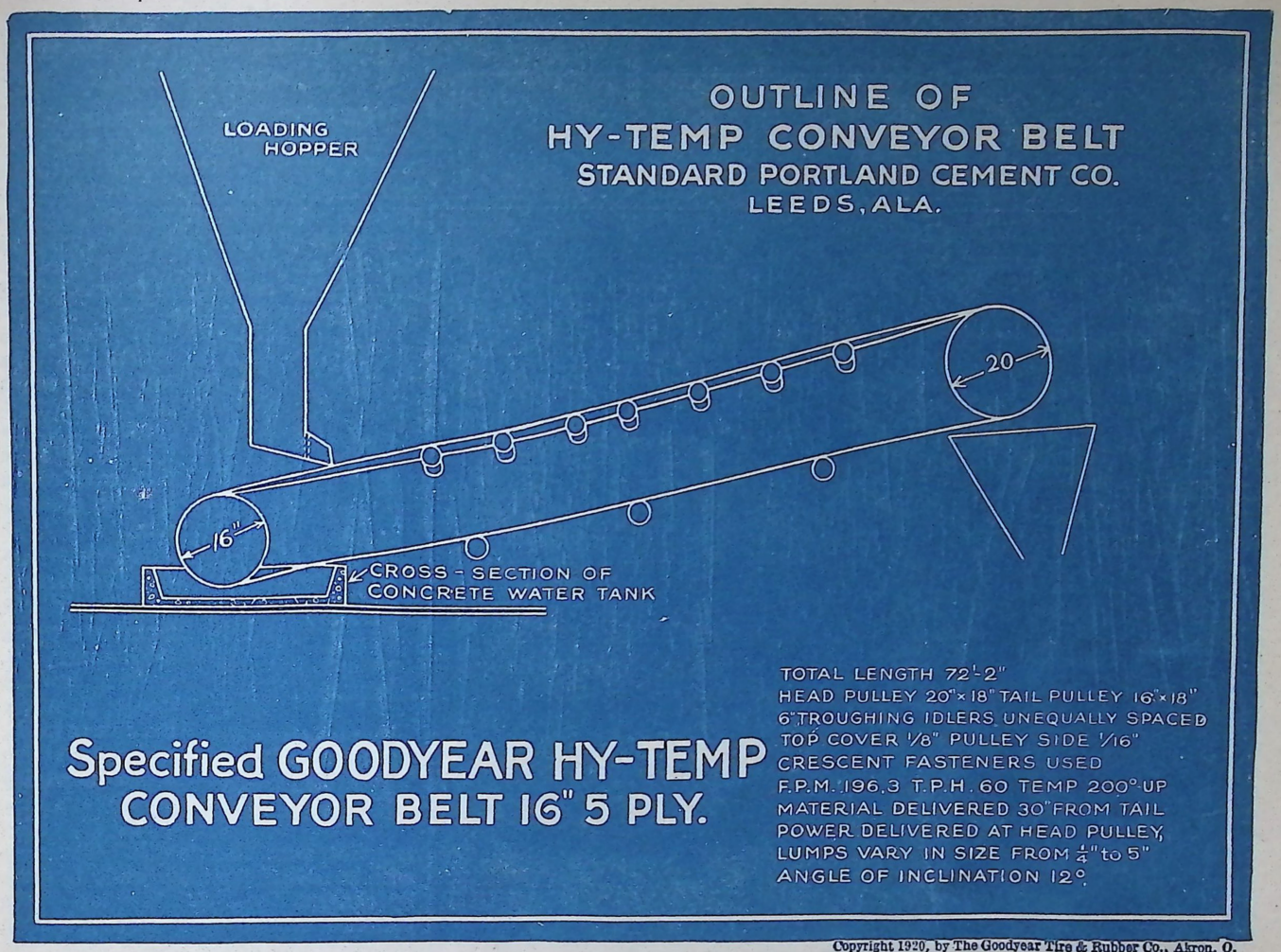
A shock is the result of touching wires of opposite polarity, or of cutting oneself into the circuit, or of touching a one-line wire and making a connection through the body to the ground. Provided one is perfectly insulated from the ground, he may safely touch one bare wire. A person should never trust a system of wiring, since a ground may come at any instant and endanger life. In handling live wires, the following rule is safe to follow:

Use only one hand at a time; keep well insulated from the ground, and from wires having opposite polarity.

The severity of a shock depends primarily upon the circuit voltage and the degree of contact made with the live wire. Contact varies with the condition of that part of the body that touches—whether dry or moist; and with the quality of the ground connection through the body. It is not always safe to touch a live wire of low potential, nor is it always fatal to make contact with a high-voltage circuit.

Danger to the eyesight and from burns is caused usually while fusing a circuit, or while throwing in or out switches on circuits carrying heavy currents. Carelessness in handling live-wire ends may cause a short-circuit and consequent injurious flashes.

Carrying too much current will cause wires to become overheated. Broken circuits cause an arc which may communicate fire.



Copyright 1920, by The Goodyear Tire & Rubber Co., Akron, O.

Hot Clinker, a Conveyor—and the G.T.M.

Hot cement clinkers, 200° and over, to be carried from open storage to the grinding mills, were the crux of the conveying problem put up by the plant superintendent to the G. T. M.

The G. T. M.—Goodyear Technical Man—gave that situation expert study embracing every process in cement manufacture at the plant of the Standard Portland Cement Co., Leeds, Ala. He realized that here was an unusual problem. The clinker could not be cooled sufficiently in the processes previous to conveying. The best thing to do would be to provide some means of cooling it as it came onto the belt.

So he made two recommendations: a heat-resistant Goodyear Hy-Temp Conveyor Belt, known to be capable of withstanding as much as 200°; and a cooling vat through which the belt might run as it struck the tail pulley and come up dripping with a film of cold water that would cool the clinker dropping from the hopper. Both recommendations were approved.

Up to September 1, 1919—after six months of operation—this Goodyear Hy-Temp Conveyor had carried 61,000 tons of clinker. The Standard Portland Cement Co. credits a saving of $300 in belt cost alone to this Goodyear Conveyor. Besides, it has effected a high operating economy. A letter from them states that the Company is "so pleased with its performance that we have ordered a duplicate for replacement, although from present appearances this belt will continue to give good service for some time."

Wherever heats up to 200° are registered on conveying jobs, in mines, in coking plants, in cement factories, Goodyear Hy-Temp Conveyor's special construction sets up new records in heat-resistance, ability to withstand abrasion, and quantity of tonnage delivered.

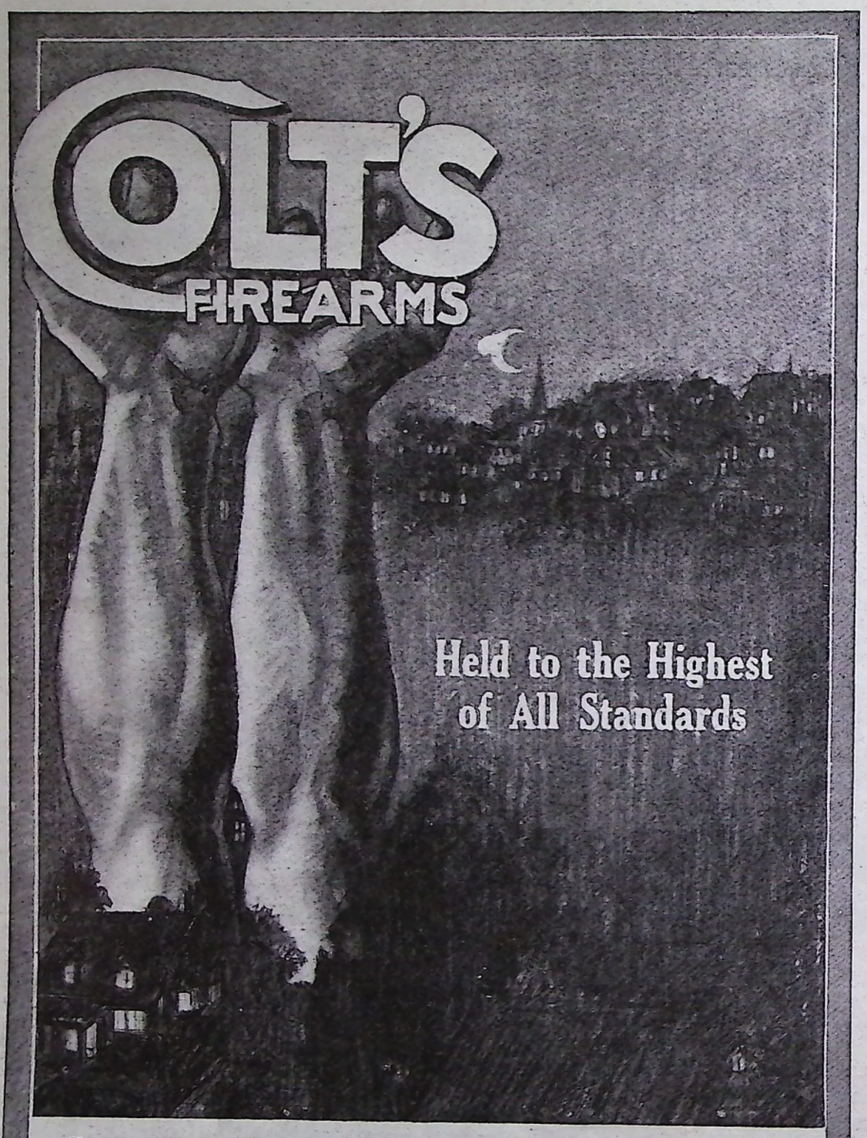
Working with your own plant superintendent, the G. T. M. can make an analysis that assures intelligent specification of the belt to the duty required. The G. T. M.'s services are yours without charge or obligation. If his suggestions and the Goodyear Belt he recommends prove as valuable in your service as in the instance cited here, and in hundreds of similar cases the country over, our return will be amply guaranteed by your satisfaction.

THE GOODYEAR TIRE & RUBBER COMPANY

Offices Throughout the World

BELTING · PACKING · HOSE · VALVES

GOODYEAR



Master Craftsmanship

NO handiwork of man possesses a finer degree of mechanical exactness, a nicer precision of working parts, a more compact strength than the creation of the master gunsmith—
And to have maintained unquestioned leadership for over eighty years—keeping step with every advance of an inventive age—is the return made by the great *Colt* factories to a trust imposed by Government request.
Since its adoption in 1911, the *Colt* Automatic Pistol, caliber .45, has been the official side arm of our Army, Navy and Marine Corps and with them did its "bit" overseas

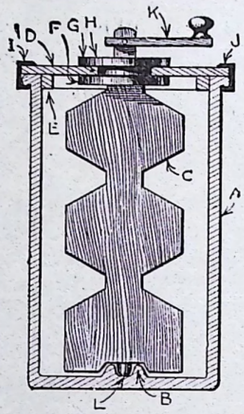
Your home needs this same *Colt* protection—the protection of "the world's *right arm*" For now that the *Colt* is back in Civilian Service you do not need to accept a "Second Best."

COLT'S PATENT FIRE ARMS MFG. CO.
HARTFORD, CONN., U. S. A
Manufacturers of
Colt's Revolvers
Colt's (Browning) Automatic Machine Guns
Colt's Automatic Pistols
Colt's (Browning) Automatic Machine Rifles

Trade Mark
Reg U S Pat. Off.

An Inexpensively Made Chemical-Mixer

A CERTAIN manufacturing company recently found it necessary to have a small capacity mixer for chemicals which would do away with metal parts as much as possible, the chemicals being of such a nature that they would eat the metal away. After some experimenting the difficulty was solved by the mixer here described.



Here is a chemical-mixer with parts made entirely of wood. Clamps hold the mixer in place

A ten-gallon crock, *A*, was purchased which had a cuplike receptacle, *B*, in the center of the bottom as shown in the illustration.

A wooden paddle, *C*, was made from wood cut from one piece. The cover, *D*, which had a flange, *E*, on the inside was made, and a revolving collar consisting of three pieces, *F*, *G*, *H*, nailed together, was fitted upon it. The cover with its collar was held firmly in place by clamps, *I* and *J*. The top of the paddle extended up through a hole in the revolving collar, and a crank and handle, *K*, was then fitted on. The bottom of the paddle was cut with a kind of round knob *L* which fitted into *B*.

When the crank was turned the paddle and collar revolved together, the cover acting as guide and holding everything in place with the clamps.—ALBERT E. JONES.

Make a Medicine-Dropper from the Stopper

OFTEN it is very necessary to measure medicine by drops, and not infrequently the medicine-dropper is mislaid or broken.

The cork medicine-dropper has advantages all its own, for it is a part of the bottle and the time saved over the old method of first filling, then expelling the liquid from the patent dropper, is considerable.

The cork stopper fitted in the medicine bottle is used. Cut a groove from the bottom to the top of the cork, about 1/8 in. deep and half as wide, then put the stopper back into the bottle.

If the stopper does not drip properly, take your jack-knife and deepen the groove still further. The exact size of the groove will depend somewhat on the quality of the cork, how tightly the stopper is fitted into the bottle, and the character of the liquid contents. Once having tried this method, you will not be likely to resort to the old.—J. T. BARTLETT.

How fast does a truck wear out?

If a truck were jacked up off the ground and the engine merely used to transmit power to some machine, it would take years to wear out the motor.

It isn't the running of a truck engine that wears it out. It's the pounding it gets from road shocks.

The life of a truck is very largely dependent upon the resiliency of the tires it rides on. Fleet-owners who have put Kelly Caterpillars on their trucks tell us that the trucks now spend their time on the road instead of in the repair shop.

The reason is simply that Kelly Caterpillars have an unusual depth of rubber and a system of side vents that doubles their resiliency.

Kelly-Springfield Tire Co.

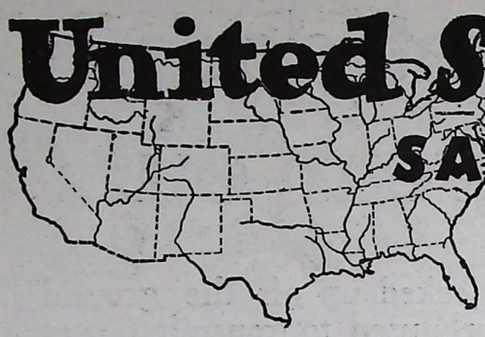
GENERAL SALES DEPARTMENT

4614 Prospect Ave., Cleveland, O.

Protected by
U. S. Patents
June 28, 1904
Aug. 31, 1915
Mar. 14, 1916
Feb. 19, 1918

KELLY SPRINGFIELD TRUCK TIRES

United States SAND PAPER

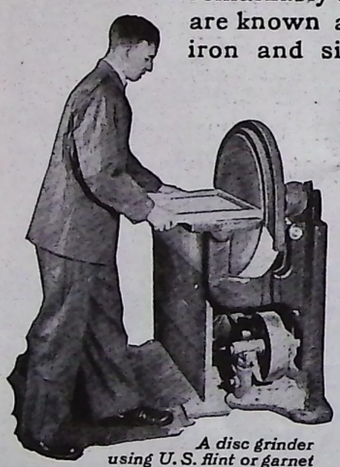


Fast-Cutting Mineral Abrasives
On cloth and paper
Flint Paper
Garnet Paper Garnet Cloth
Emery Paper Emery Cloth
Crocus Cloth
Carbalox Cloth
Herculundum Cloth
Sheets, Discs, Circles, Belts and Rolls of various widths and lengths of the above U. S. Abrasives.

Sand Paper is NOT made with sand

Sand is round; it will not cut. Sand paper is a *cutting tool.* Like other tools, it must have that which corresponds to temper; must hold a cutting edge.

Good sand paper is made by us from Nature's whitest flint rock or the reddest garnet, crushed, sifted to different finenesses and everlastingly glued to strong cloth or tough fibred paper especially made for the purpose. Other U. S. abrasives are from the fiery electric furnace; remarkably tough, and hard enough to cut metals: these are known as Herculundum and Carbalox. For cast iron and similar materials, Herculundum is ideal. Carbalox is best for steel, brass, copper, aluminum, etc.



A disc grinder using U. S. flint or garnet paper smooths wooden things up in a jiffy. Disc grinders are made in various sizes; horizontal and vertical types

In modern woodworking plants U. S. Sand Paper —flint and garnet—are used in sheets and convenient width rolls for fine hand finishing work. Here, actual *belts* of sand paper running at high speed, quickly whisk the roughness from irregular pieces. Rolls of sand paper on *drums* smooth up rough doors, sashes and other flat work. *Discs* of U. S. garnet paper on rapidly revolving wheels bite rough spots off quick as a wink.

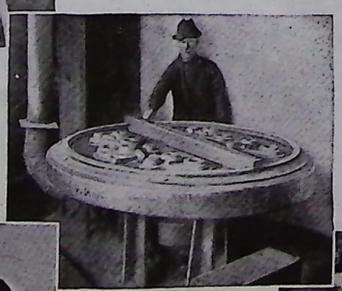
In foundries and machine shops, discs of Carbalox and Herculundum are doing fine finishing work formerly handled by planers and milling machines at great saving of time and labor. Get all the facts on this.

Everywhere, in all industries, the map trademark of the United States Sand Paper Co. is known as the mark of dependable abrasives—of quality that does not vary.

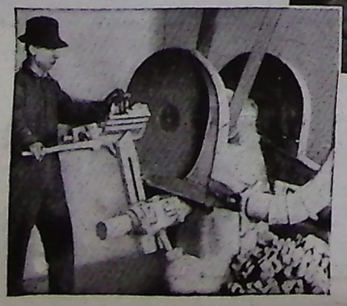
Buy your abrasive papers or cloth as you would fine tools. Our Service Department will study your requirements and recommend the grades best suited to your work. Tell us whether you work on wood, metal, leather or composition materials.

UNITED STATES SAND PAPER COMPANY
Williamsport, Pa.

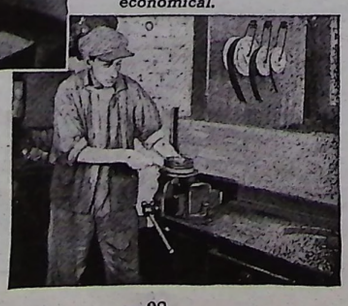
Why tear a sheet of sand paper to get a small piece? For convenience and economy, use U. S Sand Paper in rolls of various grits, widths and lengths.



U. S. Emery, Carbalox and Herculundum in rolls of various widths and grits should hang above the bench of every metal worker. Saves time: more economical.

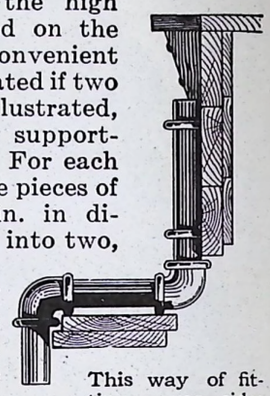


Discs of Herculundum and Carbalox glued to horizontal or vertical wheels are great time savers in finishing castings and forgings to fit. The discs last long, both cloth and grit being just right for the work at hand. Write for the complete story on this.



Pipe Brackets to Support Bottom Boards of Wagon

ORDINARILY, in dumping a wagon, the bottom boards must be lifted over the high sides and placed on the axles. This is inconvenient and can be obviated if two brackets, as illustrated, are made for supporting the boards. For each bracket use three pieces of pipe, about 1 in. in diameter, screwed into two, 90-deg. elbows. In this way a convenient ledge is formed on which to place the boards.—E. W. BUERSTATTE.



This way of fitting wagon sides doubles the load

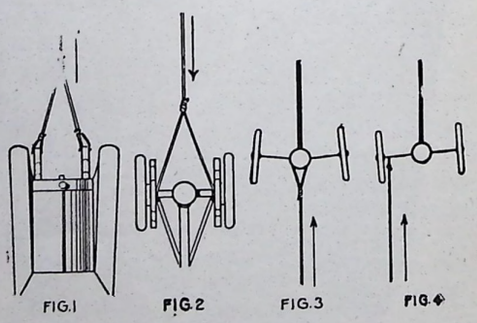
Towing a Disabled Car Without Injury

THE automobile that makes a business of towing disabled cars, as a rule, does not last long. Generally the main cause of their rapid destruction lies in improper fastening of the tow-lines.

The car being towed does not receive injury if the tow-rope is fastened to any part of sufficient strength to withstand the pulling strain. Still, it is better to attach the tow-rope to both ends of the frame, as in Fig. 1.

The nearer the fastening is made to the traction points of the towing car, the less strain the towing-car will have to undergo.

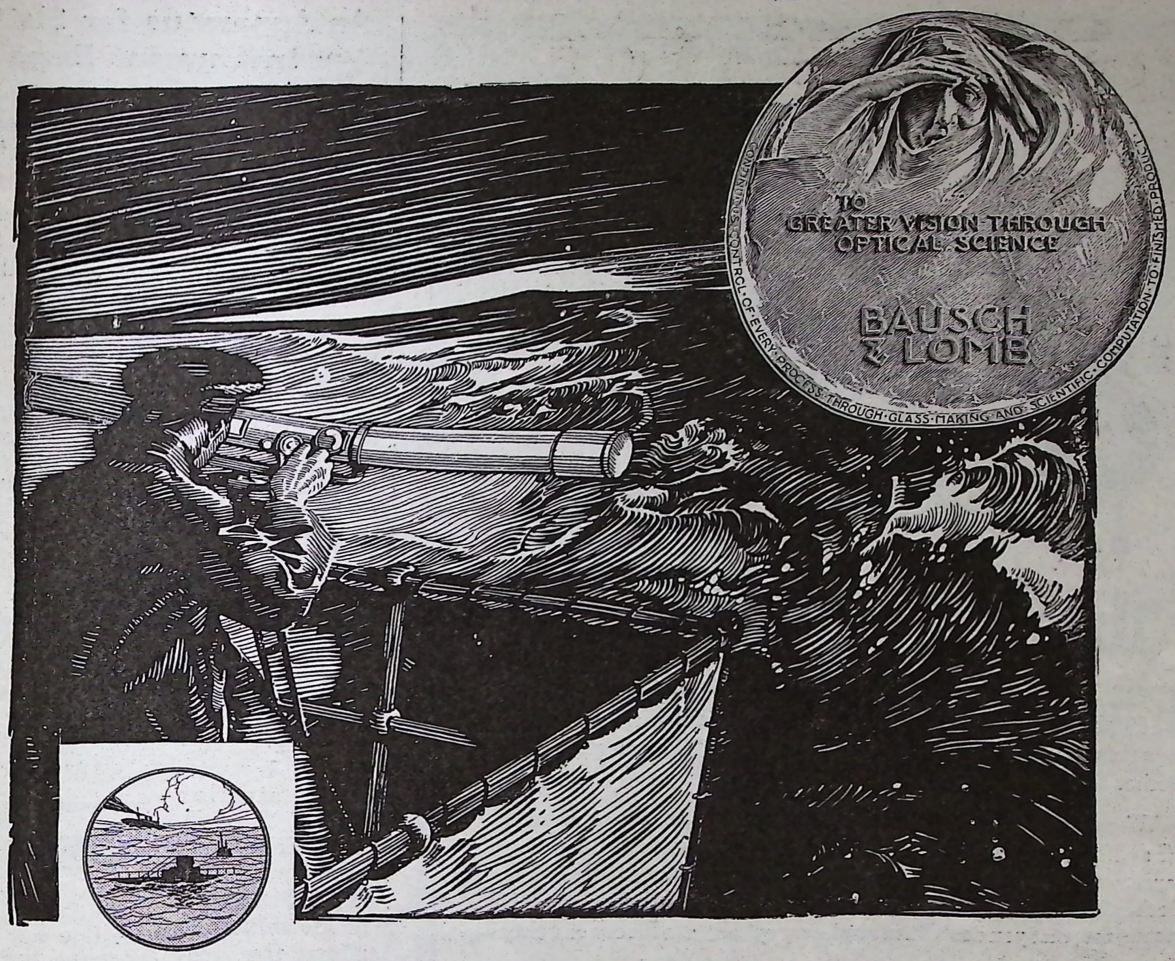
When the rope is attached to the differential housing, as in No. 3, the tendency is to spring the rear axle. When a connection is made, as in No.



At some time or other your car must be towed home. Here's the way to do it without injuring the car

4, the entire drag comes at one end of the rear axle, tending to pull the axle out of line. Of the two methods No. 4 is preferable if the tie shown in No. 2 cannot be made. Do not fasten the tow-rope to the frame of the car that is to do the towing.

When starting the car, move ahead slowly to take up the slack in the tow-rope without jerking. When under way, the driver of the towed car should keep the rope taut by using the brake if necessary.—RONALD L. PRINDLE.



Distant submarine, as seen through the range-finder.

When the Halves of the Conning-Tower Meet. Read the Range — and FIRE!

Do you know how our gunners find the range or distance of an enemy target— a submarine far off in gray wastes of sea, or an enemy post on a distant hillside? They train a "range-finder" on it, turn a screw till the halves of the image meet, and read the distance in yards or meters directly from a scale.

It is a matter of seconds only. Through deflection of light rays by a movable prism, the instrument measures angles and computes the distance, mechanically, accurately, instantly.

But distances are so great, and angles so infinitesimally small, that the slightest flaw in the glass, the slightest error in computation or formula, the tiniest deviation in edge or side of the many-angled prisms, will destroy the instrument's usefulness—turn a hit into a miss, perhaps victory to defeat.

That we were able in a great emergency to supply our Government not with the usual few score, as in former years, but literally with thousands of range-finders, and at no sacrifice of Bausch & Lomb scientific standards—

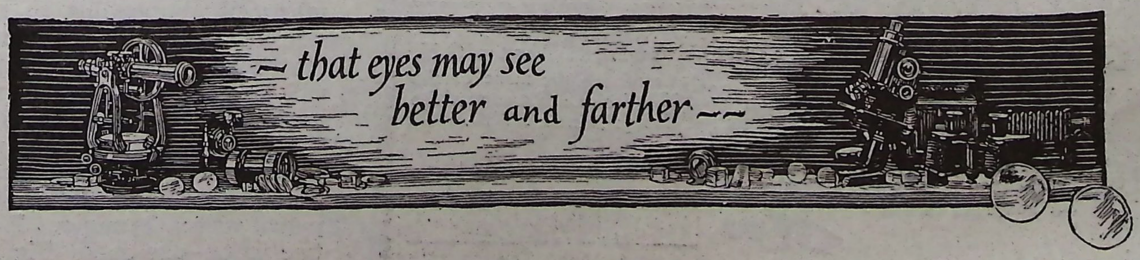
That even when working to a thousandth part of a millimeter we have been able to devise *machines* for large-scale production of range-finders, binoculars, gun-sights, aiming-circles, searchlight mirrors, periscopes—all the optical instruments of modern warfare—

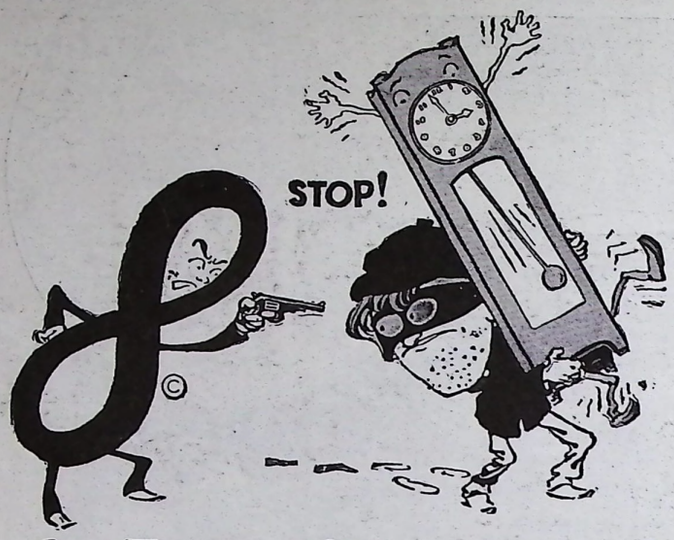
This is both a source of pride to us, and a suggestion of our equipment for the improvement of optics generally.

Write for literature on any optical product in which you are interested

BAUSCH & LOMB OPTICAL COMPANY . . . ROCHESTER, N. Y.

Makers of Eyeglass and Spectacle Lenses, Photographic Lenses, Microscopes, Balopticons, Binoculars and Engineering and other Optical Instruments





The Figure 8 saves time

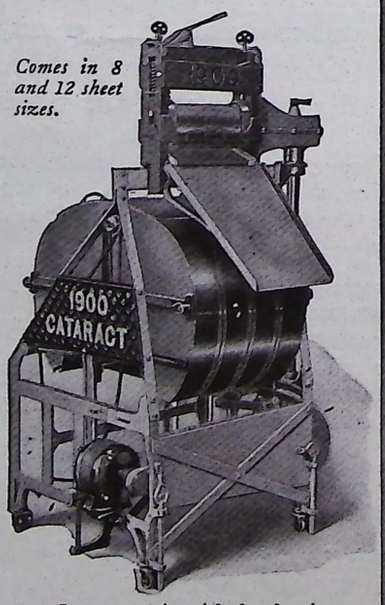
FOR it's the magic figure 8 motion of the water in the tub of the 1900 Cataract Washer that sends that water through the clothes four times as often as in the ordinary washer! Thus it washes the clothes faster and better.

When you use a 1900 Washer there's no danger of buttons flying off and button holes tearing out—not one single part in the tub to cause wear and tear! The hot cleansing water is forced through the clothes by the action of the tub alone and not by any parts! This means, too, that you don't have any heavy cylinders to lift out and clean.

These facts combine to make the 1900 the *perfect* washing machine. In addition, the swinging wringer—which also works electrically—can be shifted from the washer clear over to the clothes basket without any moving of the washer; the 1900 works easily and smoothly; costs less than 2c an hour to operate; washes a tubful of clothes in 8 to 10 minutes.

The water swirls through the tub in a figure 8 movement four times as often as in the ordinary washer.

Comes in 8 and 12 sheet sizes.



Just connect it with the electric light and off it starts.

Our Special Trial Offer

You may prove to yourself that the 1900 is the perfect washing machine. There is a 1900 dealer near you who will gladly demonstrate a 1900 Cataract Washer right in your own home. Then if you wish, you may start paying for it on terms to suit your convenience. Remember, we also have washing machines operated by hand and water power.

Write us today for the name of the nearest 1900 dealer, and a copy of the book "George Brinton's Wife." It's a story you will enjoy. Molly, his pretty little wife, had troubles of her own until she interrupted a bridge party, and then things began to happen.

1900 CATARACT WASHER

1900 WASHER CO., 206 Clinton St., Binghamton, N. Y.

Canadian Factory and Office
CANADIAN 1900 WASHER CO.
357 Yonge St., Toronto

1900 WASHER COMPANY
206 Clinton St., Binghamton, N. Y.

Please send me the name of the nearest 1900 dealer, and a copy of the story "George Brinton's Wife."

NAME _____

ADDRESS _____

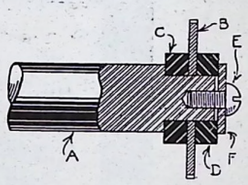
CITY AND STATE _____

An Apparatus for Slotting Instrument Bases

VERY often the amateur mechanic and model-maker has occasion to slot the bases of a number of instruments to allow wire connections to lie flush with the bottom. The apparatus described is used in a large shop where hundreds of bases, of all kinds of insulating material, such as hard rubber, wood, fiber, etc., are slotted with complicated arrangements of slots running in all directions on the base.

The device for doing the work consists of a length of shafting about ¾ in. in diameter and 18 in. long, with one end turned down to a ½-in. diameter, and back for about an inch. The saw used is a screw-slotting saw 1¾ in. in diameter with a ½-in. hole, costing but a few cents. The way the saw *B* is mounted on the spindle *A* is clearly shown by the cross-section illustration.

A thick ring or washer of fiber *C* is slipped on the turned-down portion of the spindle *A*, then the saw is slipped on, and is followed by another similar ring of fiber *D*. This last ring projects slightly beyond the end of the spindle to allow the machine screw *E*, which is screwed into a threaded hole tapped in the end of the spindle *A* and the metal washer *F*, to clamp the three securely together.



This tiny saw cuts the slot to the depth needed

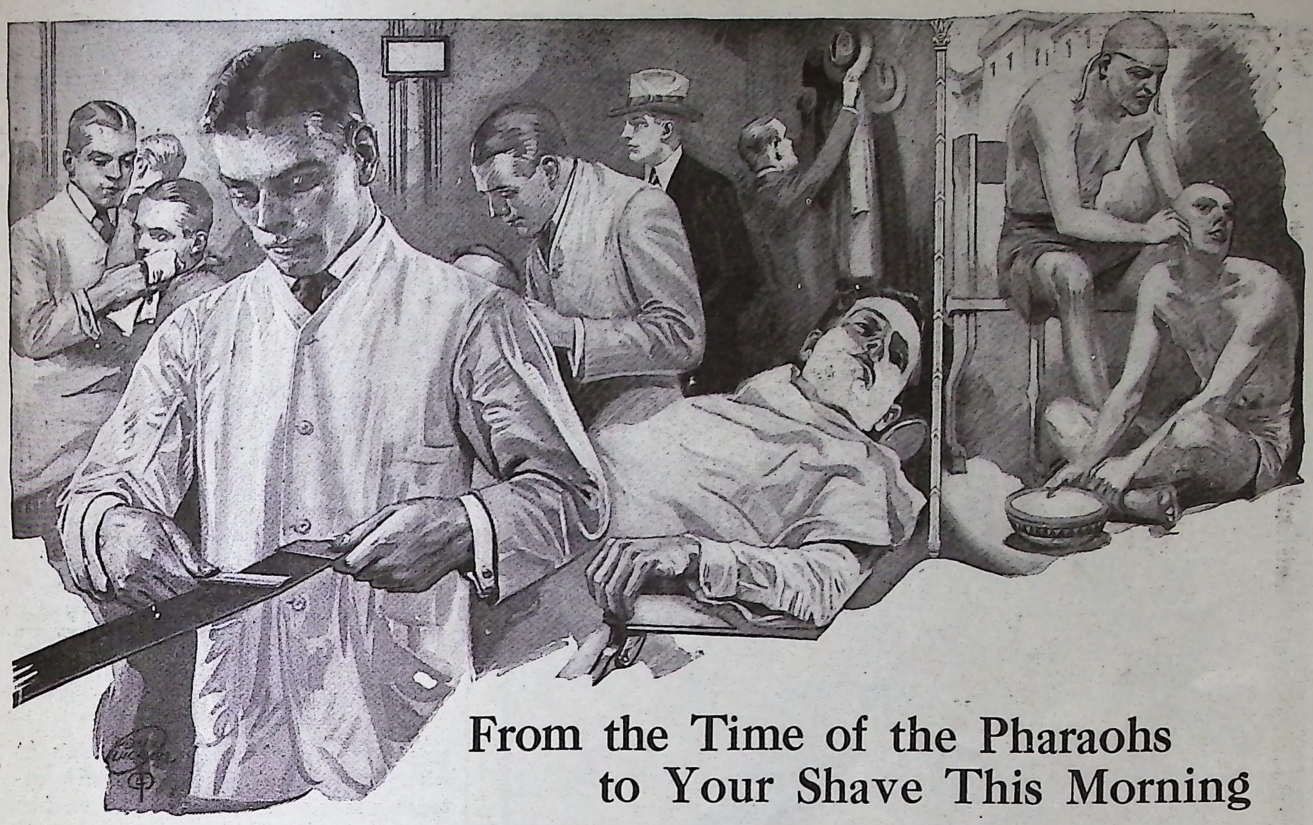
The diameter of the fiber ring regulates the depth of the slot to be cut, and a new set is required for each depth desired.

The spindle or shafting is held in the chuck of a speed lathe, with as much of it protruding beyond the chuck jaws as is necessary to allow the work to be done properly. The workman holds the base firmly in his hands, resting it against his chest to steady it. The saw is revolved with the teeth turning toward the operator and the work held against the bottom of the saw. If very sharp curves are to be made, a small saw must be used.—J. A. WEAVER.

A Double Punch for Paper, Fiber, or Rubber Washers

IT is frequently necessary to make a number of washers out of paper, thin fiber, or rubber, as shown in Fig. 1. If two punches are used it will be practically impossible to get the inside and outside circumferences concentric, and if a solid punch is used it will be hard to sharpen and the cut washers will be difficult to remove.

Fig. 2 shows a double punch that may be used to cut washers either by pressing by hand or by striking the punch with a hammer. It consists of two parts—the outer (Fig. 3) forming a punch to cut the outside diameter



From the Time of the Pharaohs to Your Shave This Morning

IN the VIIth Egyptian Room of the Metropolitan Museum of Art, New York City, there are two razors belonging to the time of the XVIIIth Dynasty (1580 B. C.)

The high-caste Egyptians of that period shaved not only the face, but the entire head. They wore wigs or other head-coverings. Those old Egyptian beards seen in ancient carvings were false beards. Sandals were owned only by the grandees, seldom worn, often carried by an accompanying slave.

The man being shaved squatted upon his haunches, the barber had the chair. And the razor then used, 3499 years ago, was the single-bladed, regular razor used by every barber without exception today.

Think of the many different sorts of razors that must have been invented, used for a time, and then dropped even from the long memory of History in the course of those 3499 years.

Those ancient razors were single-bladed like GENCO Razors of today. Barbers still use only this one type of razor, because a better tool for shaving purposes has never been discovered. Also, because they know, and will tell you if asked, that *any* blade must be stropped to deliver a perfect shave. You, too, can strop one regular razor for a perfect shave every morning.

Anybody Can Strop a GENCO Razor

Three features make stropping it almost as simple for you as breathing. Its broad back, its carefully concaved surface, and that important supporting bevel immediately behind the edge prepare each GENCO to lie against the strop just right. Your hand is guided. A few easy strokes,—three or four each way, seldom over half a dozen —and there's that keen, smoothly cutting edge which every barber knows he has to have.

You save time. You save money. You begin the day with the sort of quick, cool shave that quickens your step and mind. The morale of a good shave—we don't need to go into that with you. You need only a regular razor for a real shave.

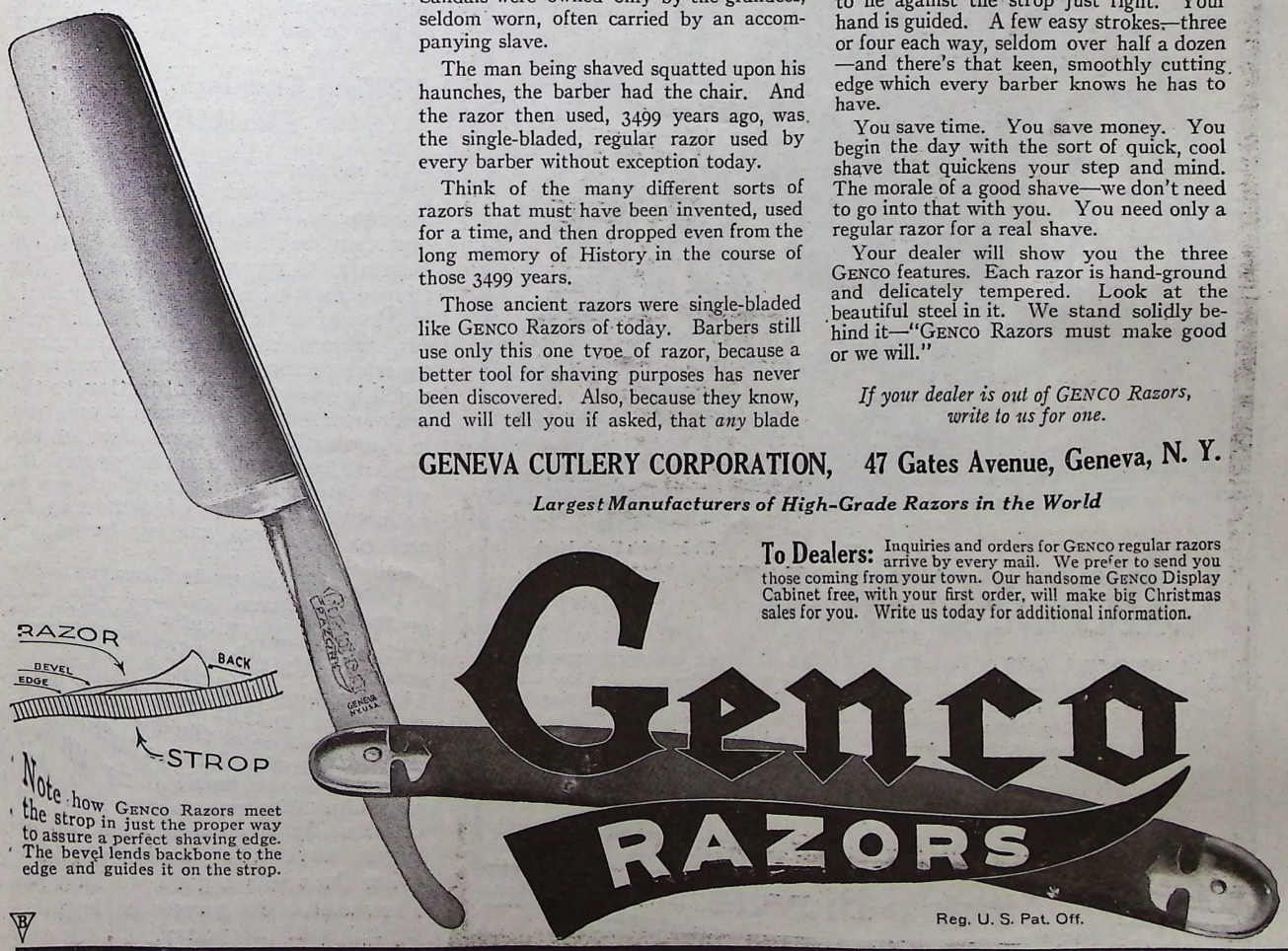
Your dealer will show you the three GENCO features. Each razor is hand-ground and delicately tempered. Look at the beautiful steel in it. We stand solidly behind it—"GENCO Razors must make good or we will."

If your dealer is out of GENCO Razors, write to us for one.

GENEVA CUTLERY CORPORATION, 47 Gates Avenue, Geneva, N. Y.

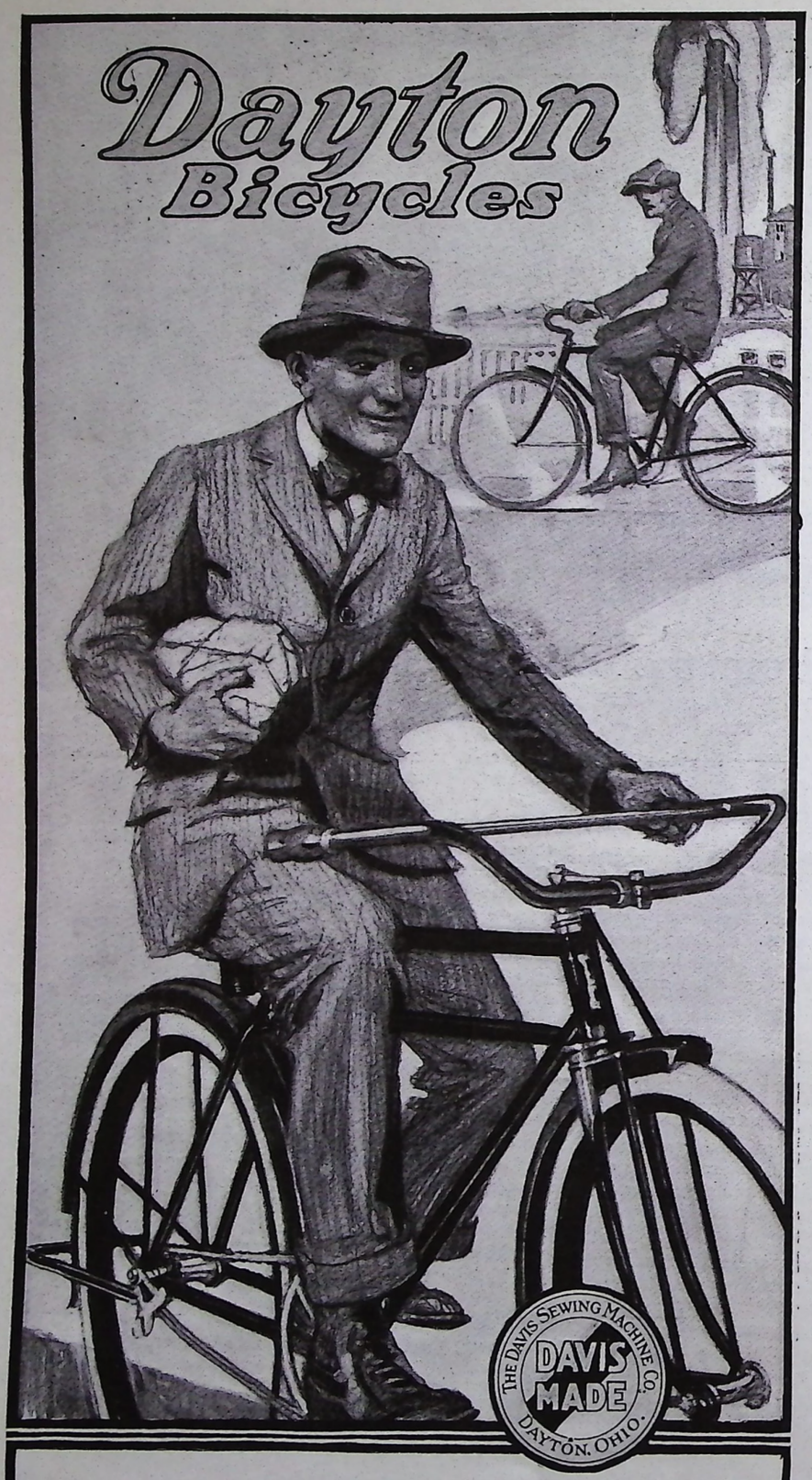
Largest Manufacturers of High-Grade Razors in the World

To Dealers: Inquiries and orders for GENCO regular razors arrive by every mail. We prefer to send you those coming from your town. Our handsome GENCO Display Cabinet free, with your first order, will make big Christmas sales for you. Write us today for additional information.



Note how GENCO Razors meet the strop in just the proper way to assure a perfect shaving edge. The bevel lends backbone to the edge and guides it on the strop.

Reg. U. S. Pat. Off.



Choose Now

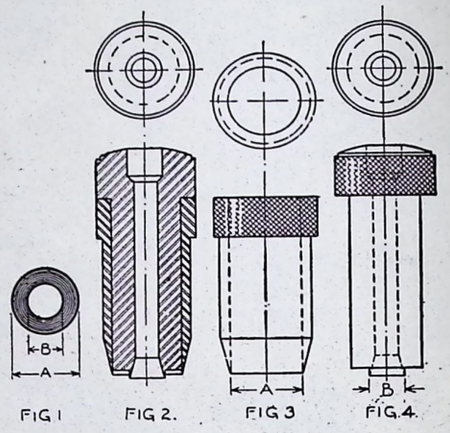
We back this Trade-Mark with our Reputation

THE WONDERFUL DAYS of Spring are "just over the hill"—and right now is the time for you to be choosing and buying the Dayton Bicycle that will make your every day a happier, more profitable day. For nearly 25 years Dayton Bicycles have been leaders in design, workmanship, quality, service and rider satisfaction. They are built with extra care and are best appreciated by those who demand superiority and painstaking attention to every little detail. Beautifully illustrated catalog pictures and describes 8 new 1920 Dayton Models—for boys, girls, men and women. Free. Write for Catalog 44 today.

Cycle Dept., THE DAVIS SEWING MACHINE CO., Dayton, Ohio

"Ride a Bicycle"

of the washer, and an inner one (Fig. 4) that punches out the hole. It will be noted that the outer punch is sloped off on the outside, while the inner one is tapered inside. The outer sleeve is drilled and reamed and the inner piece



Why buy a punch to cut out washers when you can easily make the one illustrated which serves a double purpose?

turned to make a good working fit without play. The inner punch extends slightly below the outer one, so as to get a firm hold on the material before the outer punch begins to cut. A hole through the center facilitates removal of the cuttings, and is counterbored at the top to prevent the inner hole being peened over from hammering.

For cutting paper or rubber it will not be necessary to harden the punches, but it is necessary if it is desired to cut fiber.—H. H. PARKER.

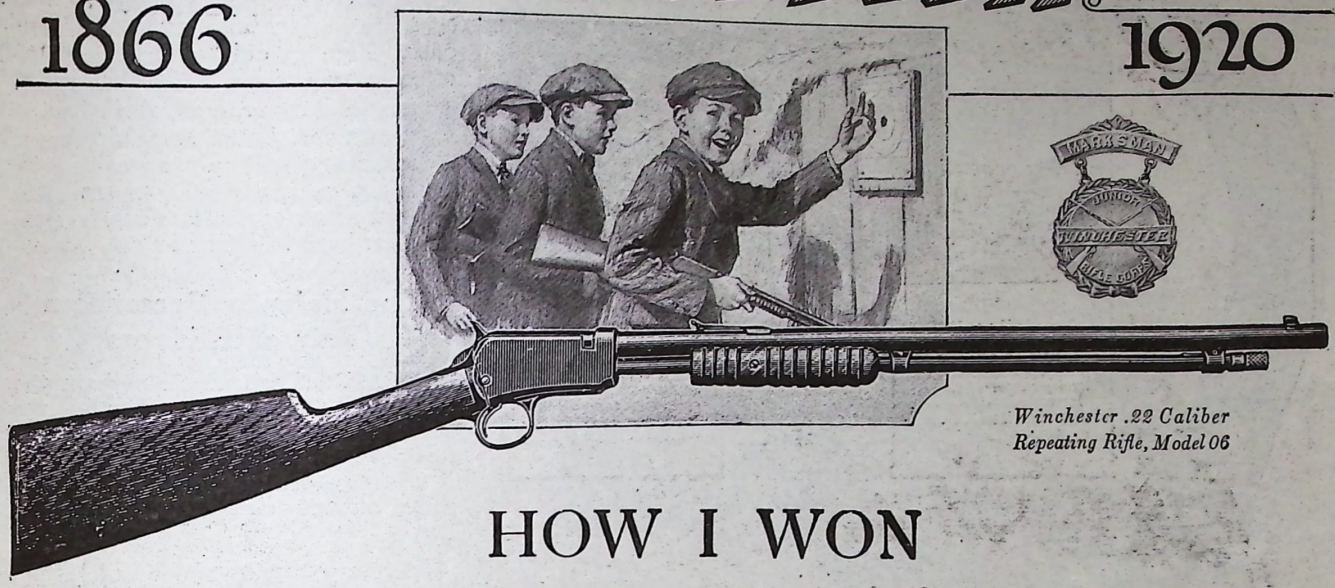
A Filing Envelope that Gives Flexibility

AN envelope filing system is very compact, and for the simple requirements of the home is one of the best that has been suggested to the POPULAR SCIENCE MONTHLY. For clipped matter, a series of big manila envelopes, alphabetically indexed under subject classifications, is much superior to the scrapbook formerly so much in vogue. The objection to the ordinary scrapbook system is one that is not flexible. A good deal of the filed matter is sure to be pasted in, which later is not desired. There is no convenient way of removing it, and so the dead matter keeps accumulating.

Here is a homemade filing container comprising three parts. The first part is the big manila envelope, as strong and durable as can be obtained. This envelope is sealed and then slit at one end. On the front is pasted a second envelope of the common letter size, the flap of which has been cut off. This holds the small filing unit, a piece of writing paper cut to fit inside. On this slip is entered a list of the larger envelope's contents. The writer finds this a good working file. The secret of its success is the index slip.—JOHN T. BARLETT.

WINCHESTER

1866 1920



Winchester .22 Caliber Repeating Rifle, Model 06

HOW I WON MY JUNIOR MARKSMAN MEDAL

WHEN my father bought me my new Winchester repeater, he said it was because I had joined the Winchester Junior Rifle Corps. But it really wasn't the fine medals that you can win in the W. J. R. C. that interested him. What he liked most of all was the rules.

The **W. J. R. C.** won't let you shoot for a medal unless you handle your rifle right and take proper care of it. Of course I wanted a medal, so I learned the Rules of Rifle Safety right away.

The distance you shoot in the W. J. R. C. is fifty feet. Five shots are fired at each target, when trying for a medal. If all five hit the bull's-eye, it counts 25. If they scatter, some shots count 4, 3, 2, or maybe nothing. It certainly is easy to scatter them!

Ten targets each counting 19 points or more, win a W. J. R. C. Marksman Medal and Diploma. It took me just three Saturdays to win mine, and I used only three boxes of cartridges.

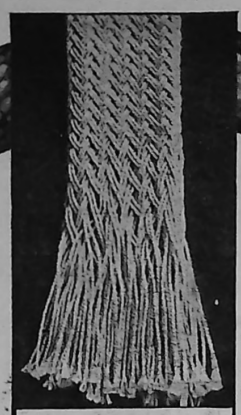
Mr. Bradley, our instructor, says I have succeeded because I have followed the rules and done what he has told me to. But I also give a lot of credit to the fine accuracy of my Winchester repeater.

You don't really need a repeater. The rules just say you must use a .22 caliber Winchester. Lots of boys have the little single-shot kinds that cost very little. And Mr. Bradley says the steel in all Winchester barrels is the same quality and they are all bored the same way. He also says that many of the most expert small-bore marksmen in the world use exactly the same Winchester cartridges we do.

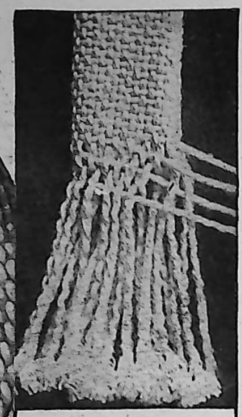
Next stop for me is Sharpshooter! The only W. J. R. C. Sharpshooter Medal in town that I know about, is on exhibition down at our leading hardware store. I don't think it is going to leave there very soon. But whoever else wants it, had better watch out for me and my Winchester repeater.

Let's go, boys! Each of you, hike down to the hardware or sporting-goods store in your community where they sell Winchester .22 caliber Rifles and Ammunition. Buy a rifle if you need one, and some ammunition; register your name as a member of the W. J. R. C., and ask for some targets and an instruction book. Then try your hand at winning a medal. Right away. If you need more information, write at once to us.

WINCHESTER REPEATING ARMS CO. ··· NEW HAVEN, CONN., U. S. A.



Here is the ordinary braided cable covering. Note the open and porous construction, easily cut, stretched or unraveled. Compare it in detail with Duracord.



*This is Duracord. Thick, heavy strands, **woven** like a piece of fire hose, not braided. Picture shows outside covering only with impregnating compound removed.*

You judge its strength

THE outside covering of a portable cable gives it its *mechanical* strength. Underwriters demand that the electrical strength, the copper and the insulation meet their requirements—but you must decide whether the covering makes the cord as strong as it should be where the wear comes—*on the outside.* You must decide between *braided* covering and *woven* covering. Economy demands the decision.

DURACORD
TRADE-MARK

is protected by a covering of thick heavy strands woven like fire hose. It can be battered and pounded and abused, and stands up as no other cord will. The illustrations tell part of the story.

No wonder Duracord resisted the pounding of heavy test hammers twenty times longer than braided cord. No wonder it withstood abrasion tests fifteen times longer than cord with ordinary covering. Field tests are even more convincing of its unusual strength. Made in all sizes for every purpose.

Let us send samples of Duracord and ordinary cord. Show them to your purchasing agent. Get your engineer's opinion. Test and compare them yourself. We'll rely on your judgment.

Ask your electrical jobber about Duracord, or write us.

TUBULAR WOVEN FABRIC COMPANY
Pawtucket, R. I.
Makers of Duraduct Flexible Non-Metallic Conduit.

To Separate Boiled Eggs from Raw Ones

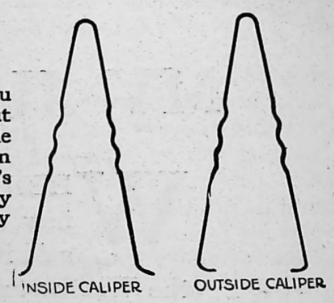
SOMETIMES, in preparing for picnics or in saving left-overs, boiled eggs are accidentally mixed with raw ones. Here is a quick and sure method of separating them: Place the eggs on a smooth surface and give them a twirl with the thumb and first finger. A boiled egg will spin around on its side just as one would expect it to do; but a raw egg will refuse to spin, however hard it is twirled.

The Hairpin Becomes a Pair of Calipers

A PAIR of calipers is perhaps the most frequently used tool in the machine-shop, being required for almost every kind of job.

One day the writer wished to take some outside measurements and he

How can you be without the humble hairpin again? It's absolutely necessary



couldn't find his calipers in the toolbox. His eye lighted on a scrubwoman in the next room and a bright idea came into his head. Why not beg a hairpin and make a pair of calipers with it? He followed up his idea, the measurements were taken, and when the job was finished it was found to aline properly.—A. G. VIDAL.

Cleaner-Cans Can Be Used as Nail-Containers

IT is often a problem for a carpenter to know how to carry nails, screws, etc., especially when he is using small brads, tacks, and hooks. Most carpenters use tea- and coffee-cans, but these have unpleasantly sharp edges.

One man solved the difficulty by using the discarded cans in which commercial bone-meal cleansers are commonly sold. These cans are made of heavy cardboard, and have a tin bottom.

By cutting a can in two, a box of any desired height from one to four inches is obtained. Such a box is light, strong, and of just the proper width for the fingers to enter. For larger nails, which occupy more space, it can be made higher. For small brads, screws, tacks, and the like, of which only small quantities are usually kept on hand, the box can be made shallow.

A great deal of petty annoyance is thus avoided.—HENRY SIMON.

Enjoy It!

MAKE your trips to and from work a pleasure instead of a mean ride on a hot, crowded car. Ride a bicycle. Enjoy to the fullest the exhilarating tonic of fresh air and the open country.

My, how good you feel! The red blood sings thru your veins, driving away those mean morning headaches and that old sluggish feeling! You get to work feeling like taking that old job and fairly "eating it up!" Health and a clear brain go a long way towards making a successful man. A bicycle goes nearly all the way towards making a healthy man!

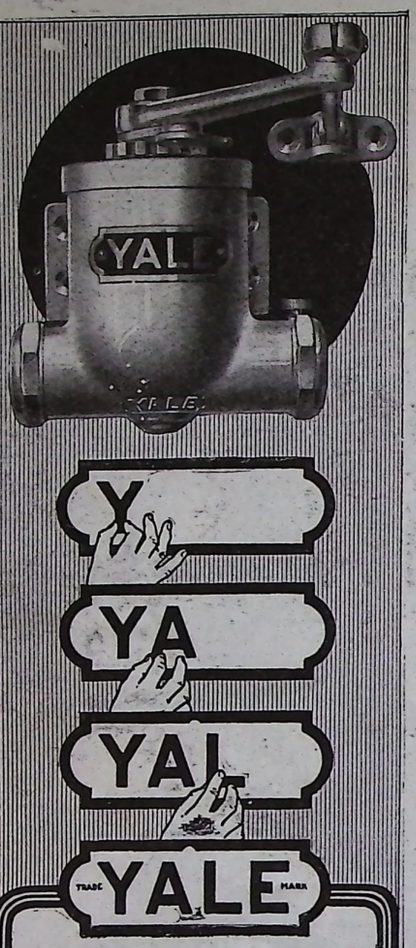
Then think of the convenience. Think of the money saved. Think of the pleasure of long rides in the country—of happy trips over broad roads! Is it any wonder that more people are riding bicycles today than ever before?

The bicycle is the most economical mode of transportation. It is the most healthful. It is a pleasant benefit for every member of your family.

Order your bicycle today. The more you ride it the more you'll enjoy it!

"Ride a bicycle"

The Cycle Trades of America, Inc.,
New York *U.S.A.*



Give your door a Yale Door Closer —and it will close as "Soft as cotton"

A DOOR not equipped with a Yale Door Closer is unwieldy, destructive, bothersome. It either crashes shut with a nerve-racking, plaster-shaking, splintering slam, or stays open, allowing chilly dust-and-germ laden drafts to sweep in.

A Yale Door Closer *completes* the door—closes it every time it is opened, silently, easily. It saves nerves, conserves heat and preserves the door itself.

Your hardware dealer will sell you the Yale Reversible Door Closer for main entrance, closet, library, kitchen, bath and screen doors. You can install them yourself, without knowledge of their internal mechanism.

See the trade-mark "Yale" on Yale Door Closers, the same trade-mark that guarantees Yale Cylinder Night Latches. Padlocks, Builder's Locks and Hardware, Chain Blocks and Electric Hoists.

The Yale & Towne Mfg. Co.
Makers of the Yale Locks
9 East 40th Street, New York City

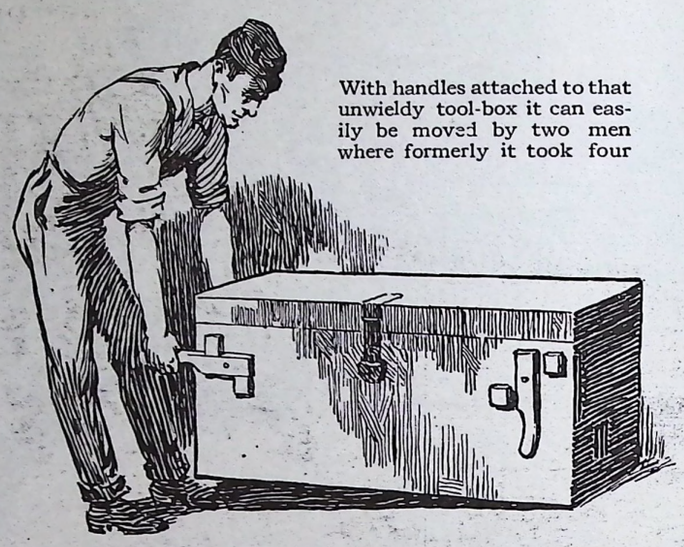
Chicago Office: 77 East Lake St. Canadian Yale & Towne Ltd. St. Catherines, Ontario

When in New York or Chicago visit our Exhibit Rooms. You will be cordially welcomed.

Folding Handles Facilitate Heavy Lifting

By Thomas W. Benson

WHERE a number of mechanics are working together on a job, the usual practice is to keep all tools locked in a large box overnight. The illustration shows a simple method for equipping such boxes with folding handles that drop down out of the way when not in use.



With handles attached to that unwieldy tool-box it can easily be moved by two men where formerly it took four

The dimensions can be varied to suit requirements. For the average box the handles are cut from strips 18 in. long, 4 in. wide, and 1 in. thick. The hole for the pivot bolt is 6 in. from one end. The stops are cut from the same material and nailed or bolted in position. Washers should be used under the heads of the pivot bolts to insure easy action. The illustration also shows the handles in both positions. When filled with tools, the box, naturally, is very heavy. Without the handles it is hard work for four men to carry it from place to place. This necessitates calling them from other work to lift the box. Try this suggestion on your tool-box—it is a time-saver.

Adapting a Gasoline Engine to Burn Kerosene

By L. B. Robbins

THE mixer on almost every gasoline engine has an exposed air-intake valve. These valves are occasionally fitted with a gate for adjusting the amount of air admitted, but as a rule they are left at a fixed opening and the mixture adjusted at the gasoline supply.

In such cases it is a simple matter to readjust the proportions of air and fuel so as to run the engine equally well on kerosene as on gasoline. This can be done to the usual style of mixer by inserting a rightly proportioned bushing in the mouth of the air intake itself. If the mouth of the intake projects downward tap into it an elbow, so that the mouth will be either horizontal or upright.

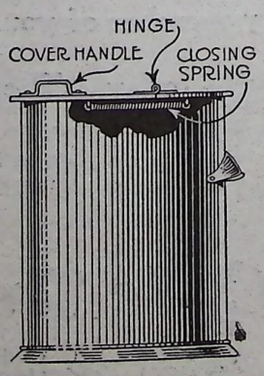
Kerosene is much less volatile than gasoline, and the object is, of course, to gasify it as quickly as possible. This calls for a little experimenting.

First, with a bushing in the air intake, pour in a little gasoline, and, closing the ignition switch, turn over the flywheel and start the engine. When it picks up on the gasoline turn the needle valve of the mixer so as to admit about half the amount of kerosene that it formerly admitted of gasoline. If the engine slows down pour in a little more gasoline until the cylinder becomes well heated. After a few moments of running the kerosene can be gradually cut down until the engine is operating on about a third the amount of fuel that was formerly used. When the proper points on the needle valve indicator are once located, mark them and you will always be able to operate the engine satisfactorily.

It is suggested that this arrangement be made on a marine or stationary engine of from one to four cylinders. It will not work to advantage upon an automobile engine, because the use of kerosene causes the cylinders to carbonize quickly.

A Soiled Waste Receptacle for Machine-Shops

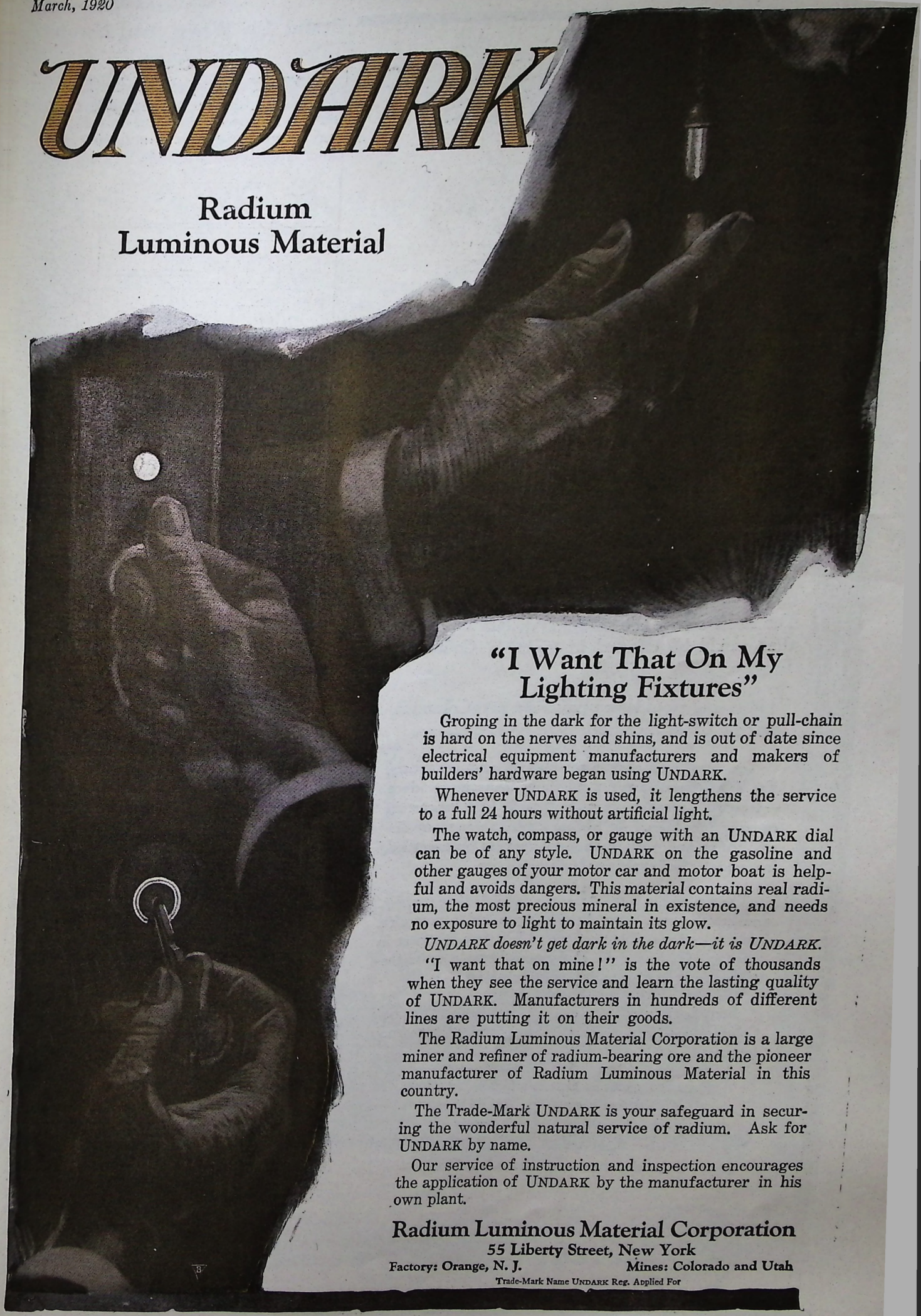
IN factories and work-shops where a lot of oily waste accumulates, some sort of safety waste receptacle should be provided. A waste can such as the one illustrated will prevent the danger of fire through carelessness and the resultant loss. The main feature is the closing spring which makes it impossible for the cover to remain open unless held in place.



By using a metal container for oil waste you avoid fire danger

UNDARK

Radium Luminous Material



"I Want That On My Lighting Fixtures"

Groping in the dark for the light-switch or pull-chain is hard on the nerves and shins, and is out of date since electrical equipment manufacturers and makers of builders' hardware began using UNDARK.

Whenever UNDARK is used, it lengthens the service to a full 24 hours without artificial light.

The watch, compass, or gauge with an UNDARK dial can be of any style. UNDARK on the gasoline and other gauges of your motor car and motor boat is helpful and avoids dangers. This material contains real radium, the most precious mineral in existence, and needs no exposure to light to maintain its glow.

UNDARK doesn't get dark in the dark—it is UNDARK.

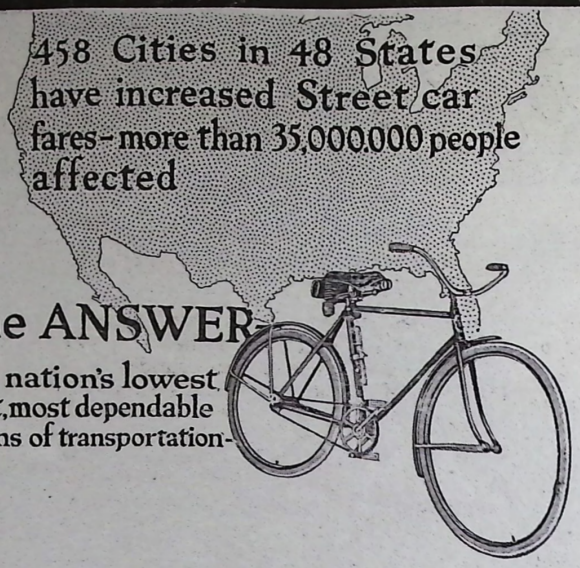
"I want that on mine!" is the vote of thousands when they see the service and learn the lasting quality of UNDARK. Manufacturers in hundreds of different lines are putting it on their goods.

The Radium Luminous Material Corporation is a large miner and refiner of radium-bearing ore and the pioneer manufacturer of Radium Luminous Material in this country.

The Trade-Mark UNDARK is your safeguard in securing the wonderful natural service of radium. Ask for UNDARK by name.

Our service of instruction and inspection encourages the application of UNDARK by the manufacturer in his own plant.

Radium Luminous Material Corporation
55 Liberty Street, New York
Factory: Orange, N. J. **Mines: Colorado and Utah**
Trade-Mark Name UNDARK Reg. Applied For



Columbia
BICYCLE

You *can* estimate the saving in dollars and cents that would be effected by riding a Columbia Bicycle.

This saving would soon pay for a new Columbia and you could then keep right on saving.

You *cannot* estimate the great *physical* and *mental* benefits a full season's use of the Columbia would produce —freedom from crowd-packed cars, from uncertain running schedules, from lost time, from those many discomfitures and work interruptions caused by unsettled, inadequate, and expensive trolley facilities.

The Columbia is the American family's time, money, and health saver. It makes getting to and from work a healthful, pleasurable pastime. Light but sturdiest in construction, dependable always, comfortable, up-to-the-minute in style lines, finish, and equipment.

Step into your local dealer's and inspect the new Columbias—he will be glad to explain their many features.

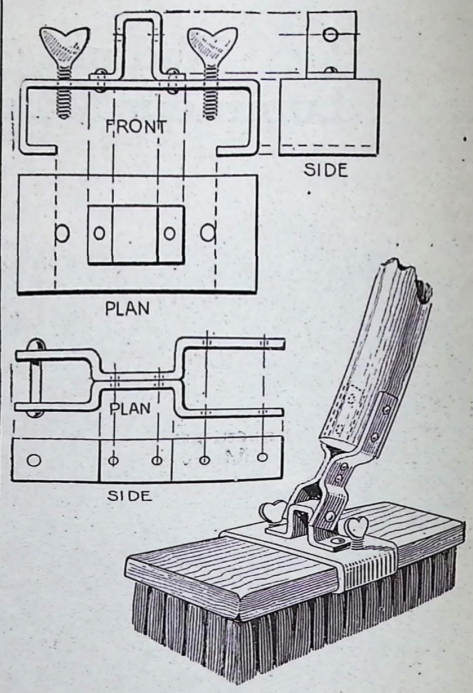
Handsome illustrated Columbia Catalog describing all 1920 models sent anywhere on request.

WESTFIELD MANUFACTURING COMPANY
45 Lozier Avenue, Westfield, Mass.

RIDE A BICYCLE

Stand Up When You Scrub the Floors

A VERY useful article and labor-saving device can be easily constructed from strap-iron. It will fit any scrubbing-brush of standard size and is designed with the idea of preventing you from assuming the old-time knee position, which is so tiring.



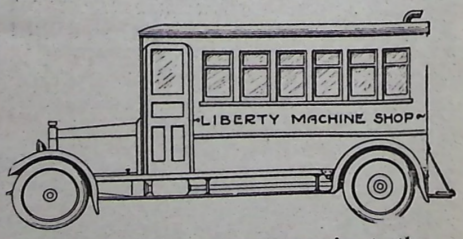
Scrubbing-brushes must be used at least once a week: why not make them as easy as possible to handle?

The top of a broom is used for the handle, and the device itself is explained in the detailed diagram herewith. Two wing-bolts make the device adjustable. Any thickness of brush can be used from ¼ to ¾ in. and any width from 2 to 3 in.

An Old Automobile Made into a Portable Machine-Shop

WISHING to better himself, an enterprising street knife-grinder gathered together enough money to purchase an old discarded jitney bus, and turned it into a self-propelled and self-operating machine-shop on wheels.

All the seats except the driver's were removed, a hole was cut in the floor for the belt, and a split pulley attached to the drive-shaft in line with the hole. The size of the pulley was adapted to the speed of the line shaft.



Instead of the customer coming to the shop the shop goes to the customer

A Remedy for Present Day Gasoline

NEARLY everyone knows that gasoline has gone down and down in grade. The fine gas of five years ago may still be purchased, but at drug store prices.

The common run of gas today has played havoc with many engines.

It has made them difficult to start on a cold day; causes frequent back firing; scored cylinders, burned bearings, abnormal carbon deposit, and amazingly frequent grinding of valves.

Many engineers saw this condition coming years ago, but the Chalmers engineers were the first to develop a remedy.

They knew there was as much power in a low grade gas as in a high grade gas.

To get out all the power that nature put in was the task.

They designed two devices—Hot Spot and Ram's-horn.

Hot Spot "cracked up" the gas to a very fine vapor after the gas left the carburetor, and then turned over the fine vapor to Ram's-horn, which dispatched it a short and equal distance to each cylinder.

The effect on gas upon striking Hot Spot is like a drop of water striking the top of a hot stove.

Imagine the "cloud" of gas then rushed through Ram's-horn, which is minus sharp corners, abrupt bends and pockets; the distance to cylinders 1 and 6 being exactly the same as to the middle cylinders.

The result is instantaneous firing; instantaneous power; no "coughing" or back-firing. Instead quick acceleration, smooth action and vibration reduced to a negligible quantity.

Your first impression in a present day Chalmers is instantaneous starting on a cold day.

Your second impression is quick power results—you do not have to run two blocks to get your engine "warmed up."

Your third impression is a total absence of vibration.

CHALMERS MOTOR CAR CO., DETROIT, MICH.

CHALMERS MOTOR CO. OF CANADA, LTD., WINDSOR, ONTARIO
MAXWELL MOTOR CO., INC., EXPORT DIVISION, 1808 B'WAY, NEW YORK

CHALMERS

WITH HOT SPOT AND RAM'S-HORN

IVER JOHNSON SAFETY AUTOMATIC REVOLVER

The Sign of Positive Safety

Iver Johnson means Safety, and Safety means Iver Johnson —the two are inseparable.

Drop it, kick it, knock it, thump it, "Hammer the Hammer"—it can't go off accidentally. And its safety is automatic—nothing to remember to do to make it safe. That's why women are not timid about having an Iver Johnson in the home.

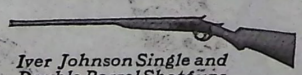
Choice of three grips

Regular, Perfect Rubber, Western Walnut.

If your dealer hasn't in stock the particular model you want, send us his name and address. We'll supply you through him.

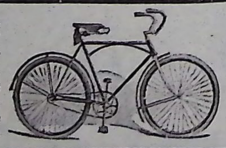
Three Booklets, one or all FREE on request
"A"—Arms
"B"—Bicycles
"C"—Motorcycles

IVER JOHNSON'S ARMS & CYCLE WORKS
343 River Street, Fitchburg, Mass.
99 Chambers St., New York
717 Market St., San Francisco



Iver Johnson Single and Double Barrel Shotguns combine accuracy and dependability.

Iver Johnson "Superior" Roadster Bicycle $55. Other Models $37.50 to $65.
[No extra charge for Coaster Brake]



ONE PIECE
On market 5 years.
1,000,000 a month.
Beware imitations.
"NO-LEAK-O"
Patented Trade Mark Reg.

NO-LEAK-O Piston Ring Co., Baltimore, Md.

TIRES 1/3 LESS

Perfect new tires, all sizes, non-skid, or plain, fabric or cord. Prepaid on approval 8000 to *10,000 Miles Guaranteed*

30,000 Customers Catalog Free Agents Wanted

Service Auto Equipment Corporation
968 Service Bldg. Kansas City, Mo.

LEARN ENGINEERING

Expert electrical engineers are being paid fabulous salaries—thousands needed today. We give you personal and thorough training—practical, technical courses 3 months to 2 years under expert engineers in electricity, steam, gas, armature winding, drafting, etc. Extensive laboratory and shop equipment. **Not a trade school.** Training is condensed—if your time is limited come to the **Finlay Engineering College**—only one of its kind in the West. Day and night sessions—enroll any time. Write for FREE catolog, a post card will do.

FINLAY ENGINEERING COLLEGE
1002 Indiana Ave. Kansas City, Mo.

Agents: 90c an Hour

Introduce "Sodereze." A new wonder. A pure solder in paste form. Works like magic. Stops all leaks. For mending water buckets, cooking utensils, milk pails, water tanks, tin roofs—everything including granite ware, agate ware, tin, iron, copper, zinc, etc.

Quick Sales—Nice Profit

Everybody buys. Housewive, mechanics, electricians, jewelers, plumbers, tourists, automobilists, etc. No leak too bad to repair. Just apply a little "Sodereze," light a match and that's all. Put up in handy metal tubes. Carry quantity right with you. Write for sample and special proposition to agents.

AMERICAN PRODUCTS CO., 2046 American Bldg., Cincinnati, Ohio

Along one side a bench was built up the proper height and shelves placed beneath it. The opposite side was fitted with a tier of drawers, while at the rear end of the bench was placed the forge, which is one of the hand-power kind. A small bench lathe, as well as a grinder, was placed on top of the bench at the front end, and a vise at the rear.

A smoke-draft hood was hung over the forge, and its smokestack run through the roof. The line shaft for running the lathe was hung in hangers to the roof. The driving pulley for this shaft has a clutch, so that when the machine-shop is on the move the machinery of the shop can be stopped.

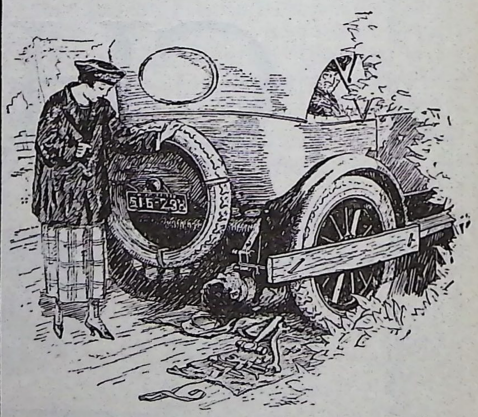
It was found that the original dome lights were not strong enough for the work, and two large barn lanterns were placed over the bench. These burned kerosene, and consequently it was not necessary to charge the storage battery to run the lights.

An acetylene welding tank and torch is carried in a rack made for the purpose, and the grinder has a very efficient money-making shop on wheels driven by its own power plant.—P. P. AVERY.

A Quick Road Repair on a Broken Automobile Axle

IF your automobile's rear axle, either right or left, breaks, a quick "get home" job can be made with a taper punch and a piece of board.

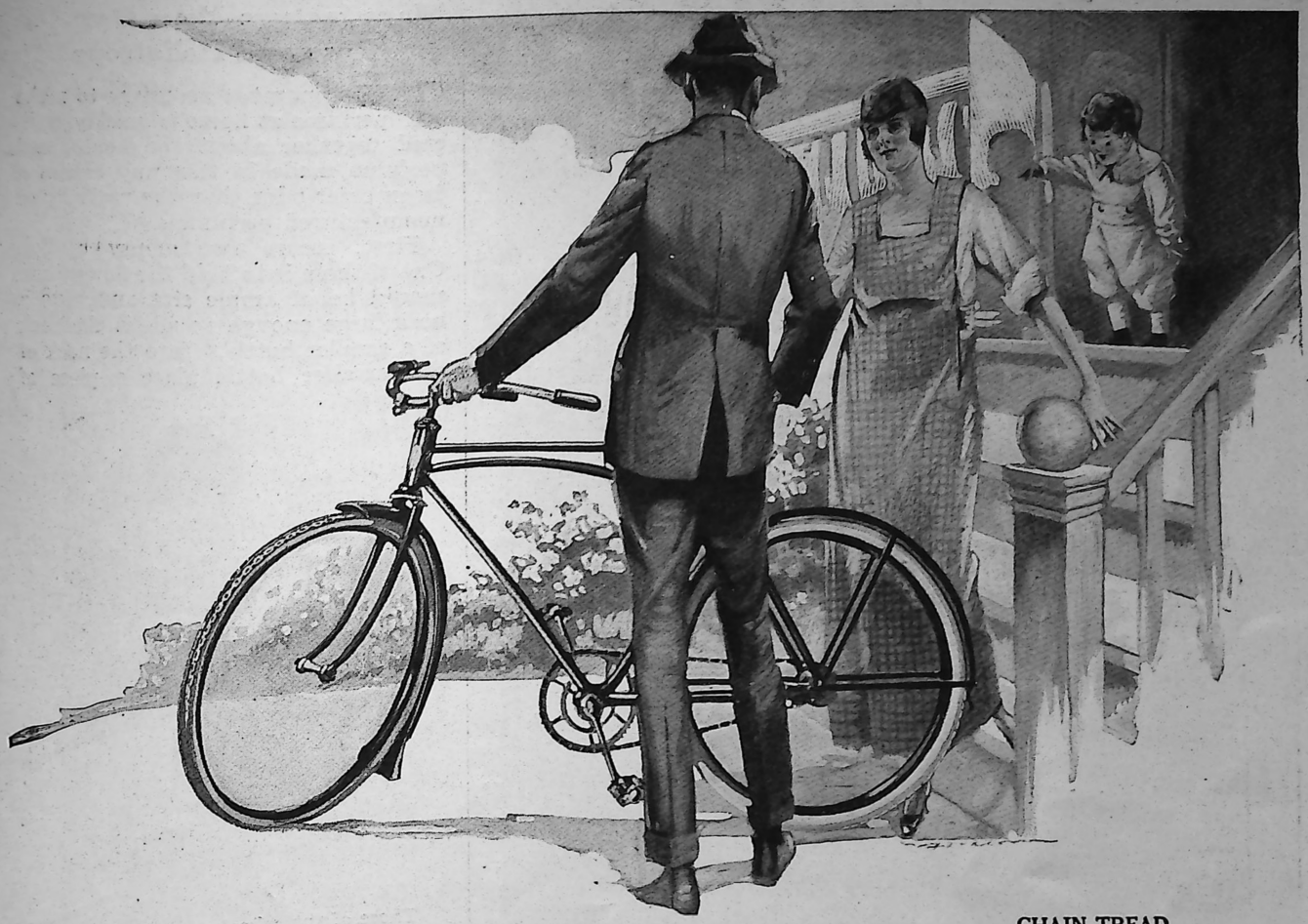
Remove the differential case-cover, insert the punch in the hole to keep it



No need to wait for the repair car if you adopt the above suggestion for repairing your broken automobile axle

from turning, and wire the board fast to the running-board and the rear end of the spring or mud-guard, as shown in the illustration. The board holds the axle in, and the punch keeps the axle and its gear from making the differential action, thus allowing the car to be driven home under its other axle.

Nine out of ten breakdowns occur in out-of-the-way places, and usually the driver is without the proper tools or parts to repair the break. By observing other motorists' methods of emergency repairs you will not be at a loss for a solution when your breakdown arrives.—P. P. AVERY.



CHAIN TREAD

The Chain Tread Tire goes straight ahead—no side-slipping or veering from the straight path—a skid with a Chain Tread Tire is an unknown quantity. And then see the bulk of good rubber in that Chain Design and then figure out the advantage you are going to gain from it in wearing qualities as well as the insurance it is to your safety. You'll make the best selection in the world when you put UNITED STATES CHAIN TREADS on your Bicycle.

Be sure it is United States

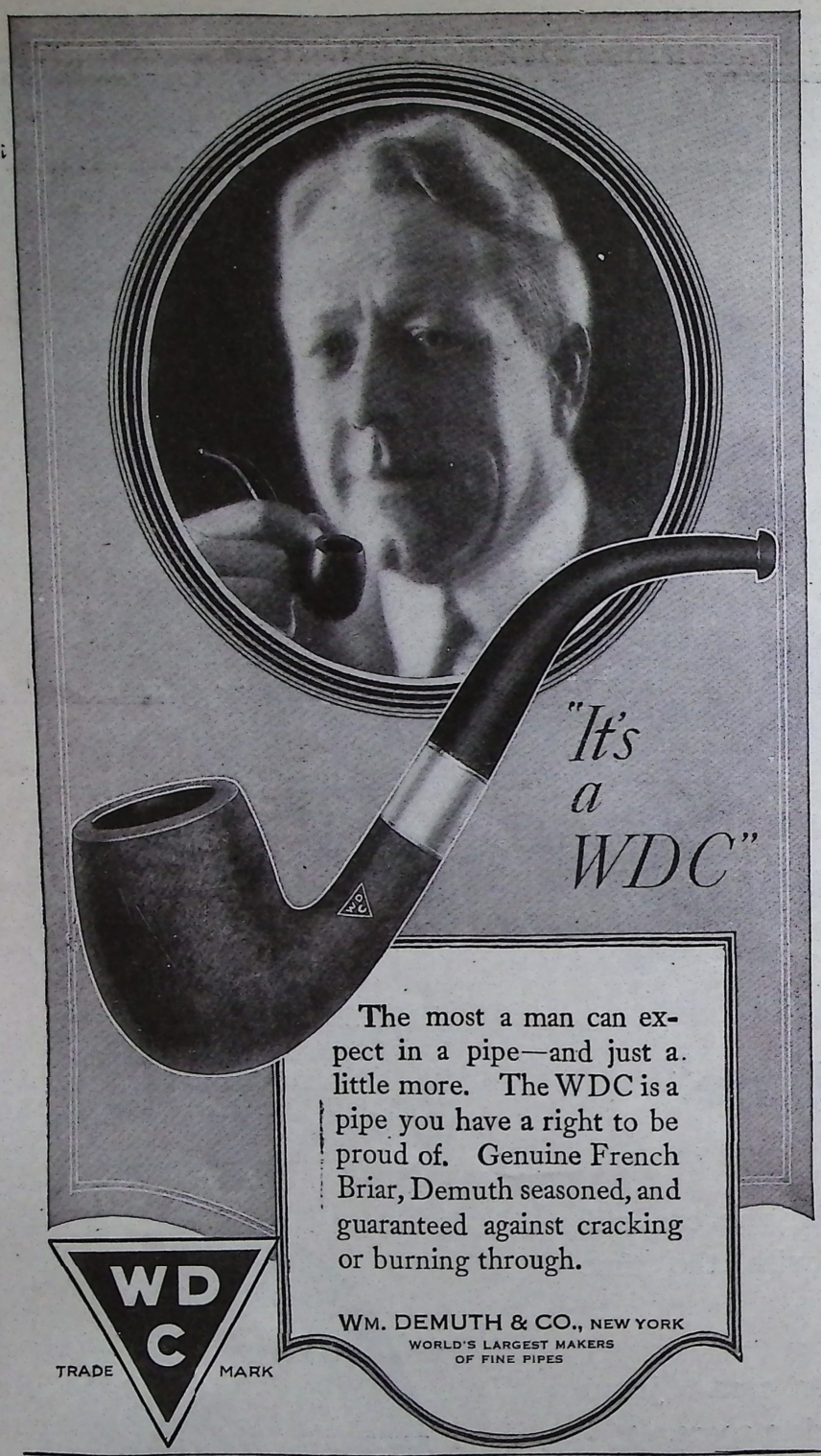
"I'll be on time"

If the alarm clock fails, you can still keep your appointment with the time clock, if you own a bicycle.

There is no waiting for cars. Jump astride and be off with speed to spare.

And remember that the most efficient bicycle is equipped with the most dependable tires—United States Tires. Made by the world's largest rubber manufacturers to live up to an established reputation for long and trustworthy service.

United States Cycle Tires are Good Tires



The most a man can expect in a pipe—and just a little more. The WDC is a pipe you have a right to be proud of. Genuine French Briar, Demuth seasoned, and guaranteed against cracking or burning through.

WM. DEMUTH & CO., NEW YORK
WORLD'S LARGEST MAKERS OF FINE PIPES

WDC TRADE MARK

FREE BOOK
How To Study Music
Learn Piano!
This Interesting Free Book
shows how you can become a skilled player of piano or organ in your own home, at one quarter usual cost. Dr. Quinn's famous Written Method is endorsed by leading musicians and heads of State Conservatories. Successful 26 years. Play chords at once and complete piece in every key, within 4 lessons. Scientific yet easy to understand. Fully illustrated. For beginners or teachers, old or young. All music free. Diploma granted. Write today for 64-page free book. "How to Study Music".
M. L. QUINN CONSERVATORY, Studio ZC, Social Union Bldg., Boston, Mass.

BE AN EXPERT
Penman
Wonderful, new device, guides your hand; corrects your writing in few days. Big improvement in three hours. No failures. **Complete outline FREE.** Write C. J. Ozment, Dept. 52, St. Louis, Mo.

SUBMIT YOUR SONG-POEMS ON ANY SUBJECT FOR OUR ADVICE. WE REVISE POEMS, COMPOSE MUSIC OF ANY DESCRIPTION, SECURE COPYRIGHT AND EMPLOY ORIGINAL METHODS FOR FACILITATING FREE PUBLICATION OR OUTRIGHT SALE OF SONGS UNDER THIS SUCCESSFUL CONCERN'S GUARANTEE OF SATISFACTION.
SONG WRITERS' MANUAL & GUIDE SENT FREE
IT CONTAINS VALUABLE INSTRUCTIONS TO BEGINNERS AND TELLS THE TRUTH CONCERNING EVERY BRANCH OF THIS ESSENTIAL AND FACINATING PROFESSION. THE GREAT WORK ACCOMPLISHED BY THE POPULAR SONG IN WINNING THE WAR IS ONLY AN INDEX TO THE MUCH WIDER SCOPE AND GREATER OPPORTUNITIES AFFORDED BY PEACE.
KNICKERBOCKER STUDIOS, 204 GAIETY BLDG., N.Y. CITY

LANGUAGES QUICKLY LEARNED ON ALL PHONOGRAPHS
"Like learning a tune—and as easy." Our disc Records repeat the correct accent and pronunciation until you know it. Family and friends enjoy language study by the
LANGUAGE PHONE METHOD and Rosenthal's Practical Linguistry
The war has created unlimited opportunity. Prepare now to better your position, or increase your business. Brush up on the language you studied at school. Write for Booklet and Free Trial Offer.
SPANISH, FRENCH, ITALIAN ETC.
THE LANGUAGE PHONE METHOD
946 Putnam Bldg. 2 W. 45th St., N. Y.

CLASS PINS
FREE CATALOG GIVE NAME OF SCHOOL OR CLUB AND NUMBER IN CLASS
Either pin illustrated made with any equal amount of lettering, one or two colors enamel. Silver plate, 25¢ ea., $2.50 doz. Sterling silver, 50¢ ea., $5.00 doz. Over 350 attractive designs in our 1920 catalog. Write today for free copy. High grade Solid gold Pins and Rings.
BASTIAN BROS. CO., 169 Bastian Bldg., Rochester, N. Y.

Dollars in Hares
We pay $7.00 to $12.50 a pair and express charges. **Big Profits.** We furnish guaranteed high grade stock and buy all you raise. Use backyard, barn, cellar, attic. Contract and Illustrated Catalog Free.
STANDARD FOOD AND FUR ASS'N
307C Broadway New York

Manufacture Your Own Old Rose and Heliotrope

THE apparatus necessary to make perfume at home is quickly gathered together about the house, and perfume made in this way carries a far sweeter odor than the majority of manufactured perfumes.

First, secure two empty bottles. One of these is to hold the flowers and should be of ample size and have a neck large enough to admit the neck of a smaller bottle. Into the neck of this smaller bottle place a piece of very fine sponge, washed clean, then saturated with pure olive oil, and squeezed dry.

Those of you who have flower-gardens can make your own perfume. It is much sweeter than the store kind

Fill the larger bottle with flowers; any kind will do as long as they have a sweet odor and are fresh. Fit the bottles together and place them in the sun. Next day throw out the old flowers, squeeze out the extract in another small, tightly corked bottle, and place new flowers in the bottle. Keep this up until the small bottle is filled with perfume, squeezing out the few drops each day. It is necessary to oil the sponge only once.

For each drop thus secured add one ounce of pure alcohol.—G. F. COLLINS.

Why Trade in Your Old Automobile?

THE engine of a good car will continue to function well years after the top and the finish on the body have become shabby. In fact, many cars are "traded in" just when the engine is at its best. All mechanics know a new piece of machinery doesn't operate smoothly until it has been run some time. Meanwhile the paint, varnish, lacquers, etc., put on to make it look attractive have lost their newness.

It is waste to discard a perfectly good engine just because the outer shell doesn't look as spick and span as it might. That defect is easily remedied.

The History of a Word

THE trade-mark "KODAK" was first applied, in 1888, to a camera manufactured by us and intended for amateur use. It had no "derivation." It was simply invented—made up from letters of the alphabet to meet our trade-mark requirements.

It was short and euphonious and likely to stick in the public mind, and therefore seemed to us to be admirably adapted to use in exploiting our new product.

It was, of course, immediately registered, and so is ours, both by such registration and by common law. Its first application was to the Kodak Camera. Since then we have applied it to other goods of our manufacture, as, for instance, Kodak Tripods, Kodak Portrait Attachments, Kodak Film, Kodak Film Tanks and Kodak Amateur Printers.

The name "Kodak" does not mean that these goods must be used in connection with a Kodak camera for as a matter of fact any of them may be used with other apparatus or goods. It simply means that they originated with, and are manufactured by, the Eastman Kodak Company.

"Kodak" being our registered and common law trade-mark can not be rightly applied except to goods of our manufacture.

If you ask at the store for a Kodak Camera, or Kodak Film, or other Kodak goods and are handed something not of our manufacture, you are not getting what you specified, which is obviously unfair both to you and to us.

If it isn't an Eastman, it isn't a Kodak

EASTMAN KODAK COMPANY,
ROCHESTER, NEW YORK.

Grandma Knows Musterole Is Best

Remember the time when you had that dreadful congestion of the lungs—and Grandma slapped a stinging, messy mustard plaster on your chest? How you writhed and tossed and begged Grandma to "take it off"?

That was many years ago. Now, Grandma gets the jar of Musterole, for now she knows Musterole is *better* than a mustard plaster.

She knows that it relieves colds, congestions, and rheumatic aches and pains.

And what is best, it relieves *without discomfort or blister.*

Musterole is a clean white ointment made of oil of mustard and other home simples.

Just rub it gently over the spot where there is congestion or pain. It penetrates down under the skin and generates a tingling, pleasant heat. Healing Nature does the rest. Congestions and pains both go away.

Peculiarly enough, Musterole feels delightfully cool a few moments after you have applied it.

Never be without a jar of Musterole.

Many doctors and nurses recommend it. 30c and 60c jars. $2.50 hospital size.

The Musterole Co., Cleveland, Ohio

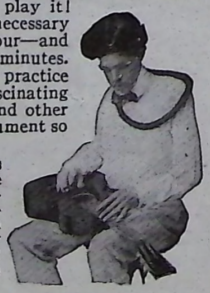
BETTER THAN A MUSTARD PLASTER

MUSTEROLE
WILL NOT BLISTER
REG. U.S. PAT. OFF.

Play the Hawaiian Guitar

Just Like the Hawaiians!

Our method of teaching is so simple, plain and easy that you begin on a piece with your first lesson. In half an hour you can play it! We have reduced the necessary motions you learn to only four—and you acquire these in a few minutes. Then it is only a matter of practice to acquire the weird, fascinating tremolos, staccatos, slurs and other effects that make this instrument so delightful.



The Hawaiian Guitar plays any kind of music, both the melody and the accompaniment. Your tuition fee includes a beautiful Hawaiian Guitar, all the necessary picks and steel bar and 52 complete lessons and pieces of music.

Send Coupon NOW
Get Full Particulars FREE

First Hawaiian Conservatory of Music, Inc.
233 Broadway, NEW YORK

I am interested in the HAWAIIAN GUITAR. Please send complete information, special price offer, etc., etc.

NAME.....

ADDRESS.....

TOWN.....P. S. M.

Things I Made that Reduced the High Cost of Living

The Popular Science Monthly will pay fifty dollars for the best answer

WHAT new use of a mechanical appliance or machine did you make for the purpose of reducing the high cost of living? We know of one fellow that transformed his coal furnace into an oil burner. Another made an iceless refrigerator. There are, of course, many other things and we want to know in how many practical ways we can reduce living expenses. Tell us! THE POPULAR SCIENCE MONTHLY offers three prizes,—a first prize of $50, a second prize of $25, and a third prize of $15,—to be awarded in accordance with the rules set forth below:

Rules Governing the Contest

(1) Contestants are not limited to the number of methods of reducing the high cost of living, but only one method can possibly win the first prize, only one the second, and only one the third. The contest is open to everybody.

(2) The method must be clearly shown either in a photograph or in a drawing. If a drawing is sent in, it need not be made by a skilled draftsman. It is sufficient that it should be intelligible. While pencil sketches will be considered, contestants are requested to make their drawings in ink on heavy white paper. The views should be sufficient in number to set forth the use of the appliance very clearly. The contestant's name and address should appear on each sheet of drawings.

(3) The drawings or photographs must be accompanied by a description, preferably typewritten, in which the method is clearly given. It must be written on one side of the paper only, and it should not be more than 500 words in length. The name and address of the contestant should appear in the upper left-hand corner of the first sheet of the written description.

(4) The drawings and description entered by contestants must be received by the POPULAR SCIENCE MONTHLY not later than 5 p. m. on Friday, April 30, 1920.

(5) The judges of the contest will be the editors of the POPULAR SCIENCE MONTHLY.

(6) The first prize of $50 will be awarded to the contestant who, in the opinion of the judges, has suggested the simplest and best method of reducing the high cost of living.

The second prize of $25 will be paid to the contestant who submits a method next in merit.

The third prize of $15 will be paid to the contestant who submits the method third in merit.

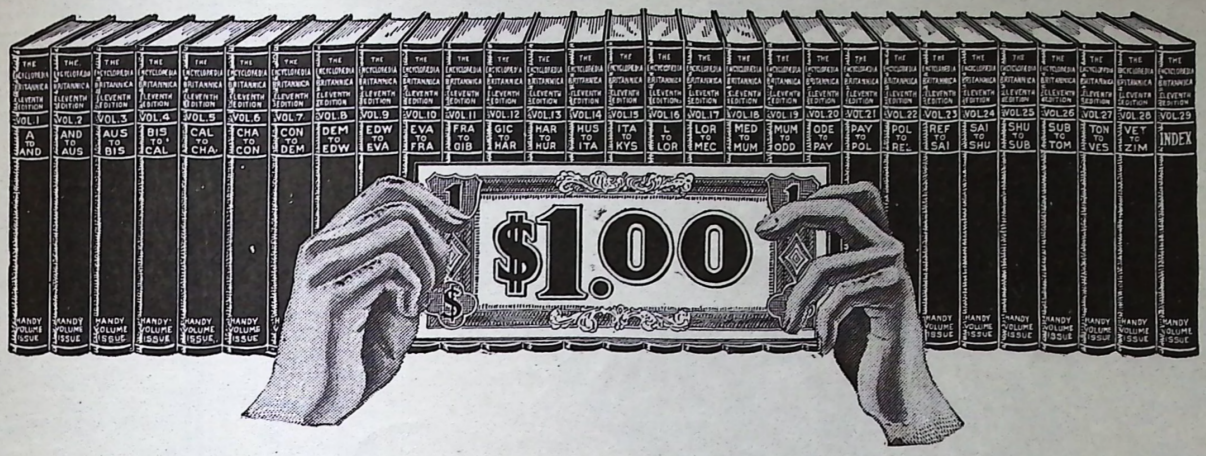
(7) The winners of the contest will be announced in the earliest possible issue of the POPULAR SCIENCE MONTHLY. A description of the methods which win the three prizes offered will duly appear in the pages of the POPULAR SCIENCE MONTHLY, together with the names of the winners.

(8) The editors of the POPULAR SCIENCE MONTHLY shall have the right to publish meritorious manuscripts which do not win a prize. The regular space rates will be paid to the contestants who submit the manuscripts thus selected.

(9) When a contestant submits more than one method, the description and drawing by which each is set forth must be sent as a separate unit.

(10) Manuscripts or drawings will be returned to contestants if stamps are enclosed.

(11) Send drawings and specifications to the High Cost of Living Editor, POPULAR SCIENCE MONTHLY, 225 West 39th Street, New York City.



Surely you can now afford to own this great library of knowledge

All Sets Remaining of the New Encyclopaedia Britannica

Printed on the Famous India Paper Offered at a Bargain

ARE you one of those who do not own a set of the new and wonderful Encyclopaedia Britannica because you THOUGHT you couldn't afford it?

Have you wanted this splendid library of facts ever since you first heard about it but NEVER INQUIRED how easily it could be purchased?

This set would give you a tremendous advantage.

Think, too, what it would mean to you, to your children, to have access to the SUM AND SUBSTANCE OF ALL HUMAN KNOWLEDGE.

Consider what a satisfaction it would mean to have at hand THE ANSWER TO EVERY QUESTION which comes to an active mind.

The Britannica covers the whole range of man's thought and activity and achievement—it contains more than 41,000 special articles—more than 500,000 indexed facts.

Both for profit and pleasure, the

Encyclopaedia Britannica

Handy Volume Issue

Is one of the best investments any ambitious man or woman can make.

To briefly describe its scope is impossible. It contains hundreds upon hundreds of articles on religion, philosophy, history, art, science, literature, manufacturing, engineering, law, physics, commerce and scores of other subjects—41,000 articles in all. It abounds in everyday useful facts that satisfy the inquisitiveness of the child mind, that enlighten the housewife, the farmer, the business man, the investigator, the educator and the lawyer.

Men and women in all walks of life are among the 200,000 owners of the Eleventh Edition.

IF YOU DO NOT OWN THE BRITANNICA, WHY NOT?

This Is Your Opportunity to Own an India Paper Set

What sets remain unsold, and these are comparatively few, are all that will be printed on the famous India paper. No more are procurable.

As you know, this very thin but strong India paper made this great work more convenient to handle and more inviting to read.

These sets are offered at prices and terms which make the Britannica a bargain to anyone who, like you, does not yet own a set.

$1 as First Payment brings you this Complete Set of 29 Volumes Containing 44,000,000 Words, 30,000 Pages, 15,000 Maps and Illustrations. The Balance Is in Small Monthly Payments.

—But You Must Act Quickly

Remember, this offer is for the new Britannica printed on genuine India paper. Act today—NOW—by clipping the coupon and sending for the beautifully illustrated book telling all about the Britannica.

Sears, Roebuck and Co., Chicago, Illinois

Sign and Send This Coupon Today.

Sears, Roebuck and Co., Chicago, Ill. (Dept. 275.)

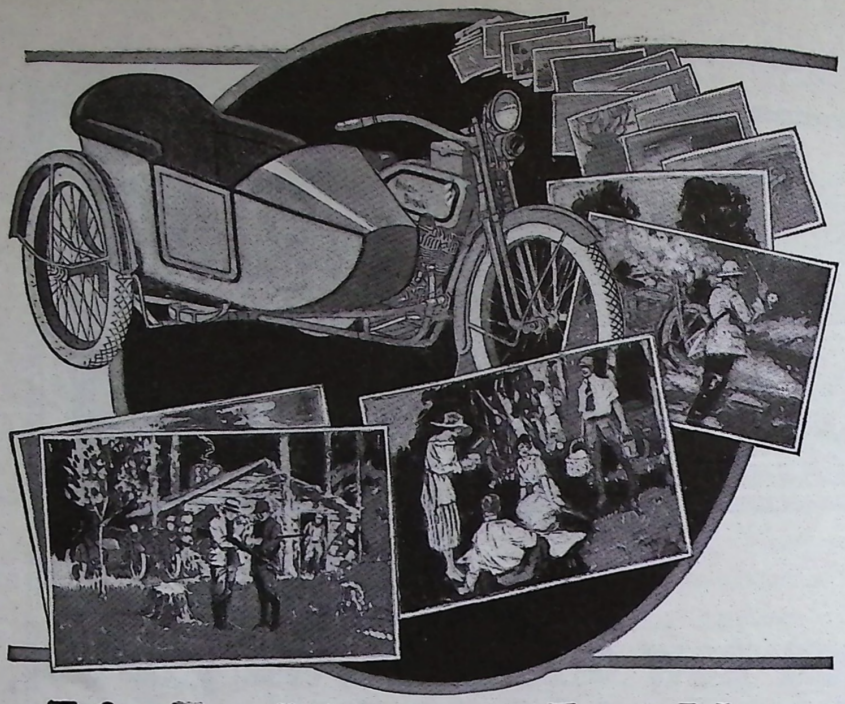
Gentlemen: Please send me, free, your illustrated Book No. 19B, giving full information about the new Encyclopaedia Britannica. Also tell me what I will have to pay for one of the remaining sets of the Handy Volume issue of the Britannica printed on genuine India paper.

Name _____

Postoffice _____

R. F. D. No. _____ Box No. _____ State _____

Street and No. _____



Fifty-Two Vacations Every Year

Every Saturday-Sunday is a real vacation for the motorcyclist. The whole countryside is near at hand!
Miles mean but pleasant minutes—distant lakes, streams and towns are but a jaunt away—when you ride a

Harley-Davidson
"World's Champion"

Fishing, picnicking, hunting and winter sports offer their pleasures every week-end when you have this swift, dependable mount to whisk you there and back.
And you can ***afford*** a Harley-Davidson—the cheapest form of quick travel. 40 to 60 miles per gallon of gasoline, with tire and upkeep costs low in proportion.

Ask Your Harley-Davidson Dealer About His Easy Payment Plan

Harley-Davidson Motor Co.
Milwaukee, Wisconsin

In Stormy Weather—Luden's

Economical protection for nose and throat. At first sign of irritation, take a Luden's. The menthol does the rest.

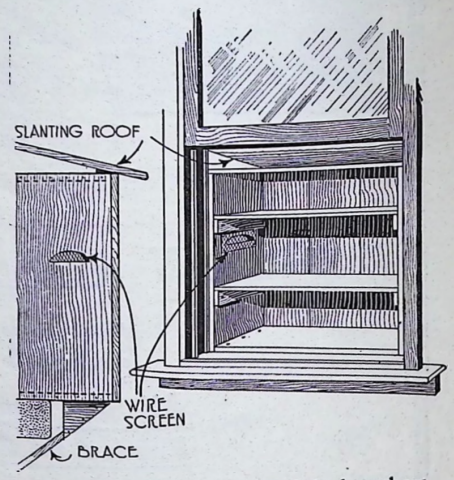
Wm. H. Luden **In Reading, Pa., Since 1881**

LUDEN'S MENTHOL COUGH DROPS
GIVE QUICK RELIEF

A Homemade Cold-Box for the Pantry Window

NOT all food preservatives are designed for the protection of eatables from warm temperatures. The accompanying illustration describes a food-container used exclusively in cold weather; hence the name cold-box.

The container is homemade, and can be attached to the outside of the kitchen or pantry window. A



The side view and front of the box show how easily it can be constructed. It will save you a big ice bill, too

northern exposure is desirable; raising the window gives access to the cold-box, without shutting off the light from the upper half of the window.

The window-sill is extended by a shelf, supported by wooden brackets. The device rests on the window-sill and the extended shelf, being fastened to the window-cases by screws or nails near the top and bottom of each end of the box. The box should have a sloping top to ward off rain. Holes for ventilation are made in the end of the box, and screened. Shelves may be made of heavy screen, poultry netting, or wood. The shelves rest on cleats fastened to the sides of the box.

Food placed in the box should be covered, as a safeguard from dust. In warm weather the cold-box can be removed if desirable.—S. R. WINTERS.

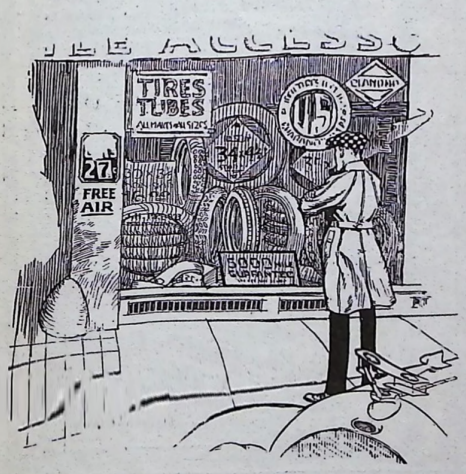
Hints for Those Who Want Tire Mileage

IN the United States today there are more than one hundred legitimate tire manufacturers, and about fifteen of this number supply practically all motorists. The smaller tire manufacturers, the "seconds" shops, the "cut-rate" and the "retread" shops, take care of what business the big manufacturers do not handle. This business is growing by bounds, and each day new motorists and even thousands of old-timers are buying cheap tires. This is like getting a quack doctor when one is seriously ill. Tire value shows itself in the cost per mile, not in the cost per tire. As in

everything else, the best tire is the cheapest in the long run, and the motorist who buys cheap tires finds that the cost per mile is much higher than is that for a standard high-grade tire.

In every large city there are shops displaying the sign "Standard Makes, 50 per Cent Off," and naturally the unwise are led to believe that they will get a regular first-grade tire at 50 or 30 per cent less than the standard tire branches can sell them for. In some of these shops you find that the tire has a name strange to you. It might be Clingstone or Soft-tread or some other name you never heard of; but the salesman tells you that it is a standard make and that this particular company is launching a new tire that is branded differently on account of its tread.

This is not the case. Standard makers take pride in stamping their trademark on their tires. A certain class of tire manufacturers do a regular business with these concerns, manufacturing tires under any name the dealer wants. Other factories market tires through various trade channels, selling as many as ten different brands of tires. These may be all from the same stock and design, though differing greatly in price. The



Did that second-hand tire you bought recently go bad? Read the article and learn just why it wasn't any good

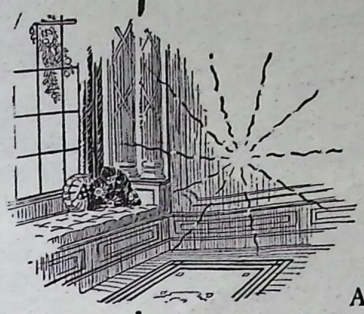
tire list in this case is a joke, because the tires never sold at list prices at all. If a tire is listed at $50 it is offered to you at 50 per cent off or $25; and this is perhaps more than the tire is worth.

Every manufacturer has a certain number of "seconds" which he must dispose of in the best way possible. The so-called "rejects" are bought up by dealers, who purchase in large lots. Included in these "seconds" are old tires that have been in stock for a long time.

When you buy a "second" tire you are taking a big chance. It may last ten miles or it may run eight thousand. If the tire happens to blow out in a short time, you lose; if it doesn't, you are lucky.

Then perhaps you buy a second-hand casing. You can't tell by look-

Walled up Alive!



A startling truth develops when the new home is all built and folks start living in it.

All the bigger problems of plan and architecture grow daily less vital. The small conveniences, insignificant when planned, become the very means to family comfort.

Indeed, the incidentals in building actually become the requisites to living—and this is never more true than electrically.

That head of stairs switch to insure your footsteps against darkness means more in your daily life than the design of the roof, whether mansard or pitched.

The reading light alongside your bed offers more real human satisfaction than the style of your windows, be they dormer or bay.

And whether you planned the library for the first or second floor doesn't hold half the importance of an arrangement of lights kindest to your eyes.

There's a Niagara of energy running through the walls of your house. But how to tap it? Walled up alive in lath and plaster, this powerful servant is restive, eager to shine and cook and sew for you.

Arrange the necessary outlets and it will emerge to take up the work. Base-board outlets, placed plentifully in every room and hall. In the laundry for washing machine and iron. In dining room for toaster and grill, in bedroom and living room for vacuum cleaner.

Comforts you value but don't always provide. Trouble is, you don't call your electrical contractor in until the building is well along. Then first estimates of cost begin to prove inadequate and common sense seems to say save, do without, cut.

Don't do it.

Remember that you are building a home to live in. That additional electrical equipment costs relatively little, and that a few extra fittings will yield endless convenience and satisfaction.

Talk it over with your architect and your electrical contractor.

Published in the interest of Electrical Development by an Institution that will be helped by whatever helps the Industry.

Western Electric Company

No. 3 *Don't think only of Western Electric as a name on your vacuum cleaner or iron, but also as an organization which serves in street lighting, in safe and rapid travel, in communication by wire or wireless—and in every other field of electrical achievement.*

BOYS

Learn Drafting

Employers everywhere are looking for skilled draftsmen. They are offering good salaries to start with splendid chance for advancement.

Drafting offers exceptional opportunities to a young man because drafting itself not only commands good pay, but it is the first step toward success in Mechanical or Structural Engineering or Architecture. And drafting is just the kind of work a boy likes to do. There is an easy delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving boys just the training they need for success in Drafting and more than 200 other subjects. Thousands of boys have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon, then mark and mail it. This doesn't obligate you in the least and will bring you information that may start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon now.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 7667, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electric Lighting and Rys.
- ☐ Electric Wiring
- ☐ Telegraph Engineer
- ☐ Telephone Work
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Machine Shop Practice
- ☐ Toolmaker
- ☐ Gas Engine Operating
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREMAN or ENG'R
- ☐ STATIONARY ENGINEER
- ☐ Marine Engineer
- ☐ Ship Draftsman
- ☐ ARCHITECT
- ☐ Contractor and Builder
- ☐ Architectural Draftsman
- ☐ Concrete Builder
- ☐ Structural Engineer
- ☐ PLUMBING AND HEATING
- ☐ Sheet Metal Worker
- ☐ Textile Overseer or Sup't.
- ☐ CHEMIST
- ☐ Mathematics
- ☐ SALESMANSHIP
- ☐ ADVERTISING
- ☐ Window Trimmer
- ☐ Show Card Writer
- ☐ Sign Painter
- ☐ Railroad Trainman
- ☐ ILLUSTRATING
- ☐ Cartooning
- ☐ BUSINESS MANAGEMENT
- ☐ Private Secretary
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Pub. Accountant
- ☐ TRAFFIC MANAGER
- ☐ Railway Accountant
- ☐ Commercial Law
- ☐ GOOD ENGLISH
- ☐ Teacher
- ☐ Common School Subjects
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ AUTOMOBILE OPERATING
- ☐ Auto Repairing
- ☐ Navigation
- ☐ AGRICULTURE
- ☐ Poultry Raising
- ☐ Spanish
- ☐ French
- ☐ Italian

Name_____
Present Occupation_____
Street and No._____
City_____ State_____

Canadians may send this coupon to International Correspondence Schools, Montreal, Canada 7-25-19

ing at it, or even by examining it closely, just how far it has run or how much mileage is left in it. A fabric break may not be visible, yet such a break will sooner or later cause a blow-out.

Retreads are in another class. An old tire carcass, properly retreaded, looks exactly like a new tire. The tread may seem new, but what good is a tread? The tread merely protects the fabric. The fabric is the real tire. There are good treads and bad treads, and you cannot tell what you are buying by looking at the tread.

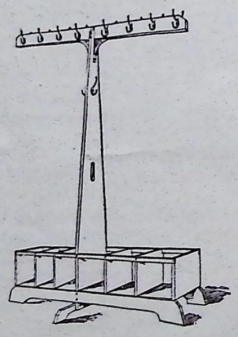
This is not condemning retreading, because a good carcass is always worth retreading. There are many concerns that retread old casings in which the fabric is still good, and in this case the owner gets good return for his money.

Here is the best advice for tire-buying: Buy the very best tires you can afford, inflate and take care of them properly, and you will get the greatest return in service for your dollars.

Doubling the Capacity of the Clothes-Closet

PERHAPS there is nothing that the housewife has wished for more often in the home than additional closet room.

The average closet is provided with hooks around the walls only. This arrangement leaves a great deal of wasted space in the center of the closet which we often wish could be utilized.



By installing this clothes-hanger you increase the capacity of your clothes-closet

The accompanying illustration shows an easily constructed contrivance designed to make use of this wasted space in the closet, which at the same time can be easily removed when the semiannual house-cleaning time comes round.

It consists of a specially designed clothes-tree, to be placed in the center of the clothes-closet, providing a number of clothes hooks and also a place below for storing extra pairs of shoes.

Of course, the size of the hanger should be regulated to fit your own needs and the closet in which it is to be used. The one illustrated was just 64 inches from the floor to the top of the cross-bar, and was provided with an opening in the center of the upright, as shown, so that it could be lifted with ease.

After the device was completed it was given a good coat of flat white paint.—MORTIMER V. TESSIER.

Last Big Block
OF THE CANADIAN PACIFIC RESERVED FARM LANDS

THIS announces the offering of the last big block of the Canadian Pacific Reserved Farm Lands. Until this block is disposed of you can secure at low cost a farm home in Western Canada that will make you rich and independent. Never again on the American Continent will farm lands be offered at prices so low.

Last Big Opportunity

This block contains both fertile, open prairie and rich park lands in Lloydminster and Battleford Districts of Central Alberta and Saskatchewan. Farm Lands on the rich prairies of Manitoba, Saskatchewan and Alberta, averaging about $18.00 an acre. Lands in Southern Alberta under an irrigation system of unfailing water from $50 an acre up.

Twenty Years to Pay

The Canadian Pacific offers you this land under a plan of long term, easy payments that is remarkable in the history of farm investments. You pay down 10%. Then you have no payment on the principal until the end of the fourth year, then fifteen annual payments. Interest is 6%. In Central Saskatchewan, Seagar Wheeler grew the world's prize wheat. World's prize oats were grown at Lloydminster.

Lands Under Irrigation

In Southern Alberta, the Canadian Pacific Railway has developed the largest individual irrigation undertaking on the American Continent. This district contains some of the best lands in Canada. An unfailing supply of water is administered under the Canadian Government. Prices range from $50 an acre up on the same easy payment terms. $2000 loan in improvements. Twenty years to pay back.

Special Rates for Homeseekers and Full Information

The Canadian Pacific will not sell you a farm until you have inspected it. To make this easy, special railway rates have been arranged. Do not delay your investigation. This is the last great block of Canadian Pacific Reserved Farm Homes. Send today for complete information — without obligation.

M. E. THORNTON
Supt. of Colonization
Canadian Pacific Railway
965 First St., E., Calgary, Alberta
For all information about Canada, ask the C. P. R.

96-Page Book Catalogue Sent Free

WE have just issued a 96-page Book Catalogue listing about 2,500 of the most recent Scientific and Technical books and a new 32 page book list of new books of 1919. These are all the more welcome by reason of the fact that both the publishing and importing of books have been very much upset by the war, and many books can only be supplied with great difficulty. This catalogue will be sent to any address in the world, free on request.

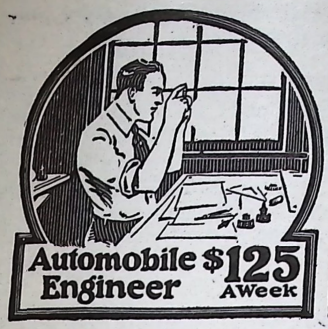
Scientific-American Publishing Company
Woolworth Bldg. 236 Broadway, N. Y.

CLEARTONE PHONOGRAPHS
$4.00 to $200.00 Retail

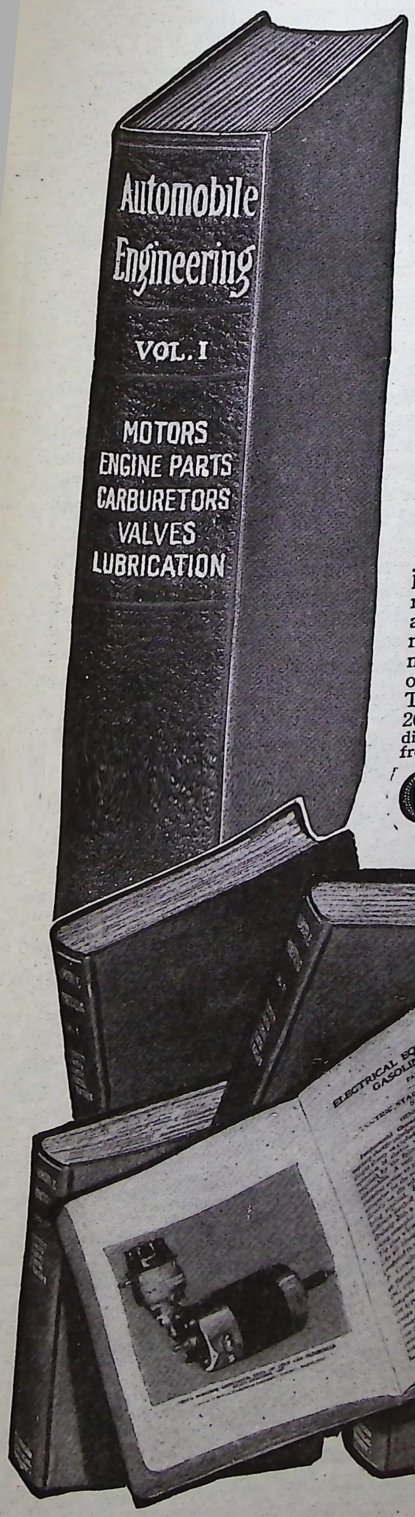
Our Sundry Dept. offers Needles 39c. per thousand, in lots of 500,000. Motors $1.35 to $14.75 each. Tone Arms and Reproducers $1.30 to $5.75 per set. Main Springs 20c. to 90c. each. Records, Needles, Sapphire Points and Parts at reasonable prices.

Write for our 64 page catalogue, the only one of its kind in America, illustrating 33 different styles of Talking Machines and over 500 different Phonographic Parts.

LUCKY 13 PHONOGRAPH COMPANY
Export Dept. 46G, E. 12th St., N. Y., U. S. A.



Take Your Choice of These Big Paying Jobs



THOUSANDS of men like you are wanted to fill these big-paying jobs in the automobile engineering field. Thousands of places are open, too, for chauffeurs and garage managers. It's easy to get one of these good jobs and to prepare yourself to hold it. You don't have to go to school. You don't have to serve an apprenticeship. Spare time only is needed. These great automobile books will teach you everything you need to know. Fifteen of the greatest engineers and experts in the business wrote them in simple language that anybody can understand.

Auto Books

6 Volumes Shipped Free

Just off the press—the 1920 model—an up-to-the-minute six-volume library on Automobile Engineering, covering the construction, care and repair of pleasure cars, motor trucks and motorcycles. Packed full of advance information on Lighting Systems, Garage Design and Equipment, Welding and other repair methods. Contains everything that a mechanic or an engineer or a motorcyclist or the owner or prospective owner of a motor car ought to know. Anybody can understand them. Tastefully bound in American Morocco, flexible covers, gold stamped, 2650 pages and 2300 illustrations, tables, blueprints and explanatory diagrams. A library that cost thousands of dollars to compile but that comes to you free for 7 days' examination. Over 50,000 sets of previous editions have been sold.

Partial Contents

Automobile Motors; Welding; Motor Construction and Repair; Carburetors and Settings; Valves, Cooling; Lubrication; Fly-Wheels; Clutch; Transmission; Final Drive; Steering Frames; Tires; Vulcanizing; Ignition; Starting and Lighting Systems; Shop Kinks; Commercial Garage; Design and Equipment; Electrics; Storage Batteries; Care and Repair of Motorcycles; Commercial Trucks; Gas Tractors.

128 Blueprints of Electric Wiring Diagrams

Only 7c a Day!

Not a cent to pay in advance. First you see the books in your own home or shop. Just mail coupon and pay express charges when books arrive. You can read them and study them for seven whole days before you decide whether you want to keep them or not. If you like the books, send only $2.80 in seven days and $2 a month until the special introductory price of $21.80 has been paid. (Regular price $30.) Along with the set goes a year's consulting membership in the American Technical Society. (Regular price $12.) This part of our offer will be withdrawn when the membership is filled. Mail the coupon without delay.

Don't Send Money Now!

Don't take our word for it. **See the books without cost.** Here is a chance for you to get a real man's job with a man's size pay. Don't waste a minute in sending the coupon. **Put the coupon in the mails today. Send no money—just the coupon!**

American Technical Society, Dept. A-203 Chicago, Ill.

FREE Examination Coupon

American Technical Society, Dept. A-203, Chicago

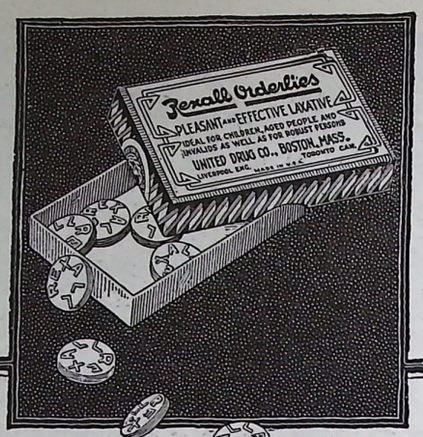
Please send me the 6-volume set of Automobile Engineering for 7 days' examination, shipping charges collect. If I decide to buy, I will send $2.80 within 7 days and the balance at $2 a month until the $21.80 has been paid. Then you send me a receipt showing that the $30 set of books and the $12 Consulting Membership are mine and fully paid for. If I think I can get along without the books after 7 days' trial, I will notify you to send for them at your expense. [*Please fill out all lines.*]

Name.....

Address.....

City..... State.....

Reference.....



They work naturally and form no habit

They work naturally and form no habit

At the 8000 Rexall Stores only
8 for 10¢
24 for 25¢
60 for 50¢

World's Best Roofing at Factory Prices

"Reo" Cluster Metal Shingles, V-Crimp, Corrugated, Standing Seam, Painted or Galvanized Roofings, Sidings, Wallboard, Paints, etc., direct to you at Rock-Bottom Factory Prices. Positively greatest offer ever made.

Edwards "Reo" Metal Shingles

cost less; outlast three ordinary roofs. No painting or repairs. Guaranteed rot, fire, rust, lightning proof.

Free Roofing Book

Get our wonderfully low prices and free samples. We sell direct to you and save you all in-between dealer's profits. Ask for Book No. 398

LOW PRICED GARAGES

Lowest prices on Ready-Made Fire-Proof Steel Garages. Set up any place. Send postal for Garage Book, showing styles.

THE EDWARDS MFG. CO., 348-398 Pike St., Cincinnati, O.

FREE Samples & Roofing Book

Why use Coal or Wood?

Turn a Valve and Cook or Heat

THE OLIVER OIL-GAS BURNER makes any cooking or heating stove a gas stove. Burns coal oil (kerosene). No coal or wood. Cooks and bakes better. Cheaper. Keeps your home warmer. You regulate flame. FITS ANY STOVE ANYWHERE. No fires to start, no ashes, no chopping, shoveling, poking and dragging of coal. Saves hours of work and loads of dirt. Simple. Safe. Easily put in or taken out. No damage to stove. Lasts a lifetime. Thousands of delighted users. In use eight years. Money-Back Guarantee. Free literature

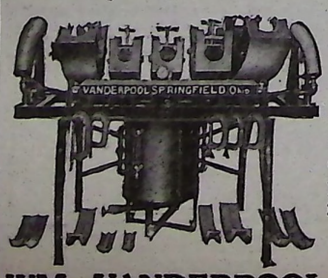
AGENTS WANTED

OLIVER OIL-GAS BURNER & MACHINE CO., 1333 N. 7th St., St. Louis, Mo

Western Orders Shipped From Frisco.

The Oliver Oil Gas Burner makes 2 gals. oil equal 97 lbs. coal

Earn $100.00 a Day Repairing and Retreading Tires



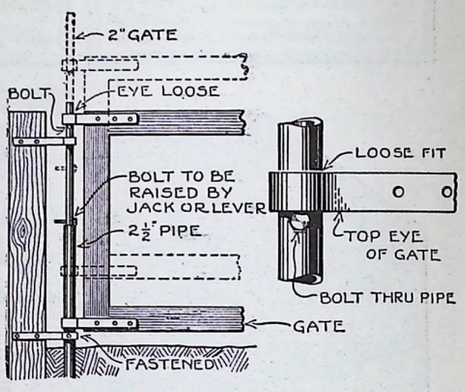
Business good and fast growing. Wonderful opportunity to get into a most profitable business. Hundreds of cars. Hundreds of customers. Our Free Tire REPAIRING MANUAL gives full particulars and shows how to do the most satisfactory work. Write today. Why slave your life away for others when your own name can go across the door and you be the proprietor and have others work for you. Vanderpool makes you successful and independent for life. Write today.

In answering address Dept. R-20

WM. VANDERPOOL COMPANY, Springfield, Ohio

Jack Up the Gate to Clear Obstructions

WHEN the snow flies and banks up in front of the big gate, how are you to open it or drive your team through without shoveling away the drift? With a gate like the one here illustrated you simply pump a few times on the wagon-jack, and the gate



No matter how high the snow-drifts pile, you can swing open the gate with this contrivance and drive through

obligingly moves up out of the snow so you can swing it open.

First, be sure your gate does not sag. Then have a blacksmith make four eyes of strap-iron. Bolt two of these to the top and bottom of the hinged end of the gate with heavy bolts, and file out the inside of the eyes until they are smooth.

Set a length of 2½-in. iron pipe in the ground so that a part about half the height of the gate will project perpendicularly above ground. Then slide a length of 2-in. pipe inside the 2½-in. piece. The bottom should touch the ground and the top reach about 2 feet above the top edge of the gate.

Use the other two eyes to strap these pipes to a solid post about 4 in. from them. The bottom eye can be tapped and bolted to the pipe if desired, but let the upper pipe slide through the top eye.

Before assembling the pipes to the post the gate eyes should have been slipped over the pipes. See that they both swing about the pipes without binding.

Drill a hole through the 2-in. pipe just under the top eye on the gate, and run a long bolt through it. Run another bolt through the same pipe just above where it emerges from the lower pipe and in line with the fence, so it projects out between the gate and the post.

A study of the diagram will explain the construction, assembly, and manner of working.

When the snow is so deep the gate cannot be swung open, simply put a jack or lever under the lower projection bolt and raise the 2-in. pipe. The top bolt, bearing under the top eye of gate, carries the gate up with it so it can be swung open above the drift.—L. B. ROBBINS.

The Care and Operation of D. C. and A. C. Motors

MOTORS should be at rest when oil-wells are filled, to prevent accident and to avoid a false oil level, due to a certain amount of oil being carried up to the shaft and linings when the motor is in operation. Use a good grade of motor oil.

To Start Motors

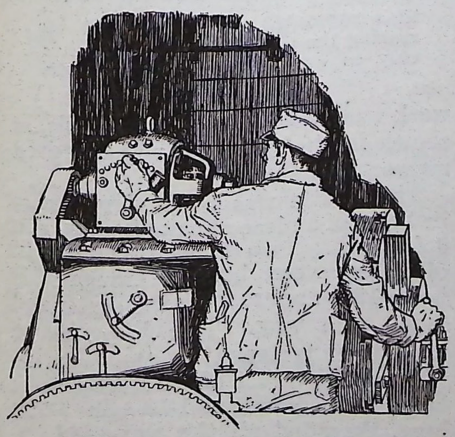
First, be sure that the rheostat arm is in the "off" position. Second, close the main switch (the line switch should always be either fully closed or fully open). Third, with hand-starting devices, move the lever of the starting device firmly on to the first contact; hold it there for two or three seconds, to allow motor armature to accelerate slowly; then move the rheostat lever from one contact to the next until it is in the last position, where the magnet will hold it.

To Stop Motors

First, open the main switch. Second, be sure the starting lever is returned to the "off" position by the time the motor stops.

If any of the contacts arc, they should be cleaned with sandpaper. See that the brushes move freely in the holders and at the same time make firm, even contact with the commutator. The commutator should be kept perfectly clean.

In case the commutator has become rough, prompt attention should be given to avoid undue sparking, heating, and similar troubles. The roughness may be removed by polishing the



Do you know how to care intelligently for an electrical motor? Here is some common - sense advice

commutator with a piece of sandstone from which a segmental piece has been cut having the same radius as the commutator. Sandpaper may be used by pressing it against the surface of the commutator with a block of wood shaped like the sandstone mentioned. In both cases the commutator should be run at a high rate of speed during the polishing, and the sandpaper should be moved back and forth along the surface,

Dentists Now Urge

A New Teeth Cleaning Method

All Statements Approved by High Dental Authorities

Leading dentists all over America are urging the adoption of a film-removing tooth paste.

Millions of people have already proved it. In every circle nowadays you see white, glistening teeth. Ask about them and the owners will say, probably, that Pepsodent has done it.

By Fighting Film

Those results come from fighting film — that viscous film which ever forms on teeth. Most lack of luster is now traced to that, also most other tooth troubles.

Film clings to teeth, enters crevices and stays. The tooth brush does not end it. The ordinary tooth paste does not dissolve it. So much of it stays and hardens, until you have it taken off in the dentist's chair.

Film is what discolors — not the teeth. It is the basis of tartar. It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhea. All these troubles have been constantly increasing for lack of a film combatant.

The Way is Found

Dental science, after years of searching, has found a way to fight film. Five years of clinical and laboratory tests have proved it beyond question.

For home use the method is embodied in a dentifrice called Pepsodent, made to meet every dental requirement. And to make it known quickly in every home, a 10-Day Tube is being sent to everyone who asks.

A Quick, Convincing Test

The Pepsodent results are evident and quick. A ten-day test will leave no doubt about them. And a book will tell the reason.

Pepsodent is based on pepsin, the digestant of albumin. The film is albuminous matter. The object of Pepsodent is to dissolve it, then to day by day combat it.

A new discovery makes this method possible. Pepsin must be activated, and the usual agent is an acid harmful to the teeth. But science has found a harmless activating method. Now active pepsin can be constantly applied, and forced into every hiding place of film.

Send the coupon for a 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how the teeth whiten as the fixed film disappears.

Look at your teeth now, then look in ten days. Let your own teeth decide between the old ways and the new. This is important. Cut out the coupon so you won't forget.

PAT OFF
Pepsodent
REG. U.S.

The New-Day Dentifrice

The scientific film combatant, now advised by leading dentists everywhere and supplied by druggists in large tubes.

319
Ten-Day Tube Free

THE PEPSODENT COMPANY.
Dept. 87, 1104 S. Wabash Ave.,
Chicago, Ill.

Mail 10-Day Tube of Pepsodent to

.....

.....

"Doesn't that feel better now, Grandpa?"

Grandpa can tell her of a thousand and one times when Sloan's Liniment routed the pains and aches of Rheumatic Twinges, Sciatica, Neuralgia, Neuralgic Headache, Lumbago, Stiff Joints, Sore Muscles.

HE always keeps it handy for those sudden, unexpected attacks. Just as thousands of families keep it handy for strains, sprains, bruises, and all other external aches and pains.

Sloan's Liniment — promptly, without skin-stain or rubbing, *penetrates*, scatters the congestion, and produces a warm tingle of comforting relief.

Get a bottle at your druggist's today. Get the *largest* bottle — greatest economy in the long run. 35c, 70c, $1.40.

Sloan's Liniment The World's KEEP IT HANDY

Tire Repairing Learn a Profession

Earn from $300 to $600 a month

Be a Tire Expert, we teach you free at our school or by mail. Thousands are getting in now. Locations are open everywhere.

SERVICE STATION Badger METHOD TIRE REPAIRING

Badger Service Stations We Put You In a Paying Business of Your Own Right from the Start

Small investment may mean a fortune to you in a short time. It assures you a large profit in a growing profession.

Motorists--Have your tires and tubes repaired by the new and famous Badger Method Tire Surgery--the only kind of work that will mean more Tire Miles to you. Badger Method Tire Repairing Service Stations everywhere.

Write today for complete catalog and full particulars on Badger Vulcanizers and How to open a Badger Service Station.

Tire Repair Equipment Co.
200 Johnson St.
Appleton Wisconsin

RAILWAY TRAFFIC INSPECTORS ASSOCIATE WITH BIG MEN

That is what gives them chances for promotion. They start in at a good salary—$110.00 a month and expenses.

The work is important, for the safety of thousands depends on their vigilance. And when they do their work as we teach them they attract the favorable attention of their superiors. Promotions then are rapid.

Learn This Profitable Profession

All you need is a common school education for entrance to our three-month's course, which is easy to learn at home during your spare time. Take the initiative now, while the demand for Railway Traffic Inspectors is so good. THERE IS A BIG DEMAND IN THIS FIELD.

We know of fine openings for our graduates. Many who started our course a few months ago now hold positions.

OUR BOOKLET tells of this ideal vocation—out in the big out-doors—how you associate with big men—how you can earn an excellent salary from the start—how you can climb to the very top. The opportunity COUPON (below) is your key to a better salary now and a much bigger future. Why not send it today? Remember you start at $110 a month, and WE SECURE YOUR POSITION.

Standard Business Training Institute,
BUFFALO, N. Y.

WE ARRANGE FOR A POSITION

Please send, without obligation to me, your Booklet D-94, explaining your Railway Traffic Inspector's Course.

Name .....

Address .....

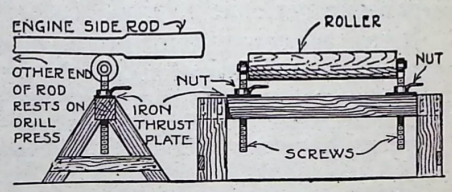
parallel to the shaft. Then carefully wipe off the commutator and brush surface to remove grit. Never use emery-cloth. If this treatment does not remedy the trouble, or if the commutator is in bad condition, call an electrician.

In the very small motors, such as those connected with adding-machines, washing-machines, etc., you will find in most cases grease-cups filled with vaseline for lubricating their bearings. They should be inspected at least once a month, and kept filled with this lubricant. The vaseline is fed to the shaft through a wick. The brushes should be taken out and cleaned occasionally.

A motor operating continuously at full load will heat up considerably. If the hand cannot be held against the heated part for longer than a minute, it is advisable to take temperature readings and report them to the manufacturer.

A Leveling Trestle for Use in Machine Work

IN the shop where I work a certain amount of work is done on engine side-rods, etc., which must be blocked and shimmed on the free end in order to level them. In order to overcome the necessity of hunting up blocks and shims of the proper size each time such



This apparatus saves man hire by making the work a one-man job; it is easy as well as inexpensive to make

work was done, a trestle was made, as shown in the diagram, which proved its worth on the first job.

The trestle was built very strong, its beam of a piece of oak 4 by 6 in. and 3 ft. long. Two holes 1 1/18 in. in diameter were bored through this beam 18 in. apart from the center and 9 in. each way. Two ¼-in. plates were then fastened on the beam to take up the thrust of the screws, these being made from two 1-in. bolts 12 in. long, threaded all the way, and the heads forged and drilled. Two wing-nuts and a roller were then made, the roller from a piece of 2-in. cold-rolled steel. The apparatus was then complete.—O. F. GERMAINE.

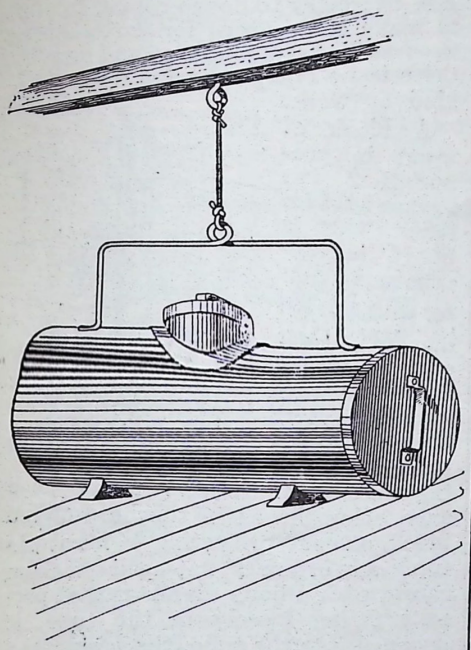
Make Yourself an Adjustable Swing Churn

CONSULT your tinsmith, follow the specifications as outlined by Miss L. Dorman, a farmerette of Mississippi, and the results will be a swing churn—a product that is at once new, sanitary, and a labor-saver. It is a homemade device, its durability

is measured in terms of half a lifetime, and the cost is negligible.

For a churn of two and one half gallons capacity, obtain a heavy quality of block tin and shape it in an 18-by-20-in. square. Place it on 2-in. legs, arrange a handle for each end as propellers, and carve a 6-in. opening through the top for pouring the cream.

The cover to the opening fits snugly on the inside, like an old-fashioned bucket lid. A substantial



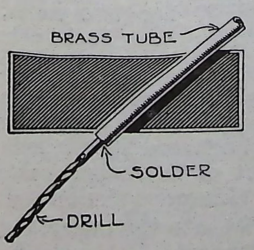
This easily made swing churn is merely shoved back and forth when it is filled with cream. It is quickly cleaned and keeps out all dust or dirt

wire handle is soldered at each end of the churn, with a ring in the center. One end of a cord is passed through the ring and the other fastened to another ring, or hook, in a beam overhead.

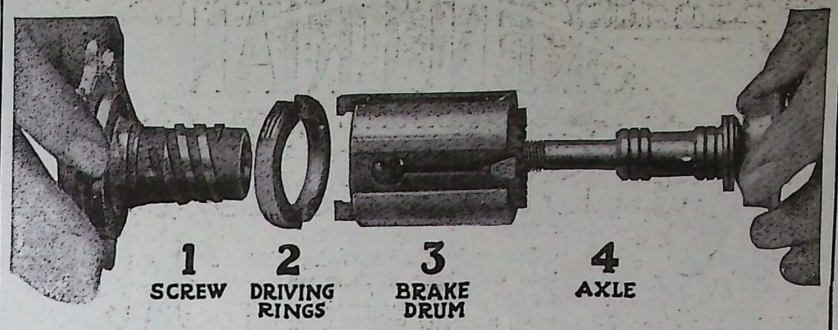
Ready for operation, the swinging device can be adjusted to any height. A small child can operate the churn, which is shoved back and forth. The sudden impact of the cream against the churn affords the friction for making the butter.—S. R. WINTERS.

Bore Difficult Holes with the Long Shank-Drill

HOW often have you tried to keep tight the bolts and nuts on your car to stop the rattle? When you tried to drill the bolt for a cotter-key, either the drill was too short or the chuck was in the way. Or, when you tried to lock the nuts on the cylinder-bolts, you could not get near them. Here is a way



If your drill doesn't reach down into that deep hole, a copper tube will help do the trick



BRING THESE FOUR UNITS TOGETHER

---and slip over them the sturdy MORROW hub (turned from solid steel) and you have as dependable yet *simple* a coaster brake as can be built—

Morrow STURDY, SURE COASTER BRAKE

ONLY *four* working units—constitute a MORROW:

1 A SCREW *of steel, attached to the rear sprocket and which fits inside the 'driving rings' and 'brake drum.'*
2 TWO DRIVING RINGS.
3 A 'BRAKE DRUM' *of spring steel, carrying bronze 'brake shoes.'*
4 THE AXLE, *passing through the 'brake drum' driving rings, screw and sprocket, and about which all revolve.*

Back pedaling expands the 'brake drum' and forces the bronze 'brake shoes' against the *entire* inner steel surface of the hub. This checks and controls the speed of your bicycle.

Forward-pedaling leaves the 'brake drum' neutral but engages two 'driving rings' which expand and drive your bicycle forward.

When your feet are idle, the 'drum' and 'driving rings' are neutral and you coast smoothly, without friction.

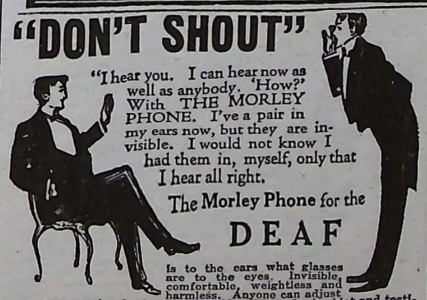
7 Reasons for the Morrow

1 Braking surface 6 3-10 sq. in.—much larger than other brakes.
2 'Drum' expansion forced equally by two wedges at each end, insuring even braking distribution over entire inner hub surface.
3 Bronze brakeshoes being softer than hard steel inner surface, grip smoothly, firmly, surely.
4 For forward pedaling, the Morrow responds instantly and positively.
5 More ball-bearings than other brakes, so coasts more easily.
6 The Morrow is strong and sturdy; it will stand hard wear.
7 Ninety-five inspections, followed by a final test, guaranteeing perfect service.

ECLIPSE MACHINE COMPANY
ELMIRA, NEW YORK

Demand the MORROW *on the next Bicycle you Buy*

"DON'T SHOUT"



"I hear you. I can hear now as well as anybody. 'How?' With THE MORLEY PHONE. I've a pair in my ears now, but they are invisible. I would not know I had them in, myself, only that I hear all right.

The Morley Phone for the DEAF

is to the ears what glasses are to the eyes. Invisible, comfortable, weightless and harmless. Anyone can adjust it." Over one hundred thousand sold. Write for booklet and testimonials.

THE MORLEY CO., Dept. 797, 26 South 15th Street, Philadelphia

What 15 Cents Will bring You From the Nations Capital

The little matter of **15 cts.** in stamps or coin will bring you the Pathfinder **13** weeks on trial. The Pathfinder is an illustrated weekly, published at the Nation's center, for the Nation; a paper that prints all the news of the world and tells the truth and only the truth; now in its **27th** year. This paper fills the bill without emptying the purse; it costs but $1 a year. If you want to keep posted on what is going on in the world, at the least expense of time or money, this is your means. If you want a paper in your home which is sincere, reliable, entertaining, wholesome, the Pathfinder is yours. If you would appreciate a paper which puts everything clearly, briefly—here it is. Send **15c** to show that you might like such a paper, and we will send the Pathfinder on probation 13 weeks. The 15c does not repay us, but we are glad to invest in new friends.

Washington has become the World's Capital and reading the Pathfinder is like sitting in the inner council with those who mold the world's destiny.

THE PATHFINDER, Box 523, Washington, D. C.

PYORRHEA LOOSE TEETH, INFLAMED, TENDER, BLEEDING AND RECEDING GUMS

This PATENT SUNLIGHT MASSAGER used and endorsed by DENTISTS in nearly all parts of world. Stops gums from BLEEDING and RECEDING. Prevents Pyorrhea. Helps to tighten loose teeth, by Vacuum Massage. It stimulates increased circulation of blood around the teeth that nourishes and develops healthy gums. Price only 50c each. Postage prepaid. Sent with complete directions, written by successful Pyorrhea Specialist. Send money order or stamps today. Money back if not satisfied.

FREE Copyright Colored Chart; illustrating DISORDERED GUMS; shows why gums shrink away, teeth become loose, wabbly and drop out. This valuable information may save your natural teeth. WE SEND IT FREE. Write for it TODAY.

Dentists, write for my special proposition. DR. A. F. LUZZI, 202 Luzzi Bldg., Houston, Texas.

SPENCERIAN

PERSONAL

Steel Pens

Spencerian Pens are today what they have been all these years—*the best pens made.* The finest pen steel, a perfect writing point and extra long life make them so. That fascinating book, "What Your Handwriting Reveals", and 10 sample pens, different patterns, sent on receipt of 10c.

SPENCERIAN PEN CO.
349 Broadway New York City

Fine, Medium, Stub and Ball pointed

The Police Key

is as serviceable as a whole bunch of ordinary keys—opens almost everything; every house-owner should have one. Sent postpaid on receipt of 20 cents, three for 50 cents. Safety Key Holder free with every key.

Sharpe Mfg. Co., Paterson, N. J.

FREE

$20

Violin, Hawaiian Guitar, Ukulele, Guitar, Mandolin, Cornet, Tenor Banjo or Banjo

Wonderful new system of teaching note music by mail. To first pupils in each locality, we give a $20 superb Violin, Mandolin, Ukulele, Guitar, Hawaiin Guitar, Cornet, Tenor Banjo or Banjo absolutely free. Very small charge for lessons only. We guarantee success or no charge. Complete outfit free. Write now. No obligation.

SLINGERLAND SCHOOL OF MUSIC, Inc. Dept. 27 CHICAGO, ILL.

LEARN DRAFTING

at home in spare time as you would in actual practice. Men and women in great demand for permanent positions as mechanical draftsmen. Our comprehensive Home Study Course qualifies you to secure and hold one of these desirable positions. No previous training is necessary to become a practical, mechanical draftsman by our successful method of home instruction We have hundreds of successful graduates now holding good positions.

EARN $35.00 to $100 A WEEK

Many of our graduates have reached high salaries rapidly owing to their practical training. They secure excellent salaries at the start—as high as $2,000 the first year. . . . Usual pay of draftsmen is $35.00 to $100 a week. Advancement is rapid.

DRAWING OUTFIT FURNISHED

We supply every student with a Drawing Outfit for use throughout the course. There is no extra charge for this and it becomes your personal property when you have completed the course.

HELP YOU SECURE POSITION

We are frequently able to place our students in good positions sometimes before they complete the course. Many concerns write us offering positions to our graduates. The demand for trained draftsmen is greater than the supply. The training we give enables students to secure positions, without trouble, on completing the course. Free book of particulars. Write today.

COLUMBIA SCHOOL OF DRAFTING

Dept. 1090, 14th & T Sts., Washington, D. C.

10 Cents a Day Pays

for This Symphonola

Plays all records, Victor, Columbia, Edison, Pathe, Little Wonder Emerson. Take a year to pay, after 30 days' trial. Compare its tone for clearness, volume, with more costly instruments. Return at our expense if it fails to make good. Ask today for the

Beautifully Illustrated Symphonola Book FREE

Shows this and other Symphonola styles sold on easy payments

Symphonola Records Get our list of the latest song, dance, popular, clear sounding, full toned disc records. Playable on any Phonograph

Larkin Co. Desk SPSM 320. Buffalo, N.Y.

Once Grown Always Grown

THE

MAULE SEED BOOK

176 pages of real garden facts

Right methods and tested seeds mean productive gardens. Maule's Seed Book gives both.

FREE

Benefit by our 43 years' experience as seedsmen, gardeners, and farmers. All the secrets of garden success and a lot of new, *unusual* features.

Send for it today

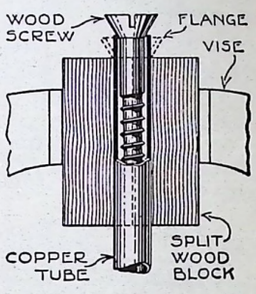
WM. HENRY MAULE Inc.
2201 Arch St., Phila., Pa.

to solve these little difficulties. All you need is a piece of copper or brass tubing with an inside diameter equal to the outside diameter of the drill or a little larger. Sweat the drill into the tube by using either a torch or soldering-iron. Make it any length you want.—O. J. THIELHART.

Flanging a Copper Tube for Automobile Connections

AUTOMOBILE mechanics find it necessary to flange copper tubing to make connections for carburetors, vacuum feed systems, etc., and usually there is no equipment for doing this kind of work.

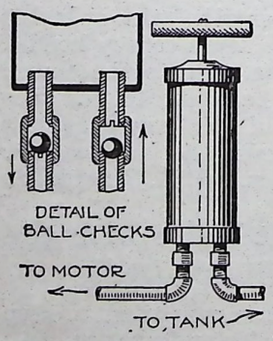
A block of wood is procured 2 in. square by 4 in. long. This is bored lengthwise in the center with a 5/16-in. drill, then cut centrally along the hole with a fine saw. This serves as a clamp for holding the tube in the jaws of a vise, the tube being placed in the bore of the block, one end projecting 1/8 in. at the top. An ordinary flat-head machine screw, with a body diameter that permits fitting loosely in the tube, is dropped into the tube, the screw then being tapped lightly with a hammer. At every blow the screw turns slightly, flaring the tube end.—R. L. PRINDLE.



Flanging a copper tube with a screw and wood block

Make an Oil-Pump from an Old Tire-Pump

THERE are times when one desires to force an extra amount of lubricating oil into the engine. This is impossible without an extra pump, and such a one is shown in the sketch. It is made from an old bicycle pump.



Here is a way to transform that old tire-pump into an oil-pump

Cut off the pump to within about 6 in. below the handle, refit the bottom cap, and tap it for two holes, one each side of the center. Fit two ball-check valves to these tapped holes. They should act in opposite directions. In this way oil drawn into the pump from the tank cannot be forced back into it, but will pass out of the other valve into the motor. Likewise the oil cannot be drawn back into the pump, but will be again drawn from the supply-tank. This pump is inexpensive and may pay for itself in a short time.—L. B. ROBBINS.

Indoors or out

Get the Drop on that Cough

ON the bridle path or in the business office—the first slight sign of a husky throat meets effective resistance from Dean's Mentholated Cough Drops. Have a box on hand—indoor or out! Get them anywhere.

Dean Medicine Company
Milwaukee, Wisconsin

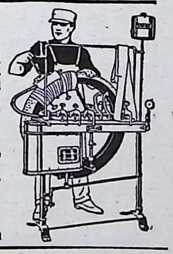
DEANS MENTHOLATED COUGH DROPS

AN EASY WAY TO MAKE MONEY Don't be content to plod along on a small salary. Be independent. Go in the tire repairing business. One man says "I made $60.00 the first day." Others average $200 to $500 a month. Very little capital needed. Jobs plentiful. Every motorist a possible customer. No experience needed. We teach you.

SHALER Tire Repair Outfit

Improved Wrapped Tread Method Used by Tire Manufacturers

Does as good work as the big high priced vulcanizing outfits. A boy can use it. It's the only vulcanizer that has Automatic Heat Control, and can't undercure or overcure a tire. Requires no watching or regulating.



FREE Book

"How to Open a Tire Repair Shop." It tells how to make big money. Don't delay. Write quick.

C. A. SHALER CO.
2114 Fourth St. Waupun, Wisconsin

Set in Solid Gold — Set in Solid Gold

Send Your Name and We'll Send You a Lachnite

DON'T send a penny. Just send your name and say: "Send me a Lachnite mounted in a solid gold ring on 10 days' free trial." We will send it prepaid right to your home. When it comes merely deposit $4.75 with the postman and then wear the ring for 10 full days. If you, or if any of your friends can tell it from a diamond, send it back. But if you decide to buy it—send us $2.50 a month until $18.75 has been paid.

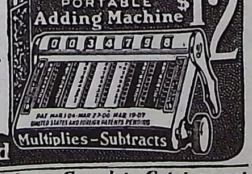
Write Today Send your name now. Tell us which of the solid gold rings illustrated above you wish (ladies' or men's). Be sure to send finger size.

Harold Lachman Co., 12 N. Michigan Av. Dept 1203, Chicago

SUPERIOR SINCE 1904

Over 100,000 in Use
Mostly sold through recommendation
For Personal Desk or General Office
It checks mental calculations. Buy through your stationer.
Write for 10-day Trial Offer
P. E. Gaucher, A. A. M. Co.
148 Duane St., New York
Canadian Agency

Golden Gem Portable Adding Machine $12



Multiplies—Subtracts

Agents wanted

Send for a Complete Catalogue of

MASONIC BOOKS Jewelry and Goods

REDDING & CO.
Publishers and Manufacturers
200 Fifth Avenue Dept. S New York

Making a Refrigerator that Needs No Ice

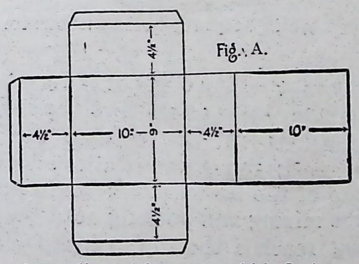
IF it were possible for you to visit an ancient Persian home you would be served with delightfully cold, pure water, in spite of the fact that your Persian host did not know what ice was.

This is accomplished by the use of a principle well known to the ancient Persians. Your host placed the water in an earthenware water jug, which being porous would become wet through. The dampness, coming in contact with the warm air outside, would cause evaporation on the outside of the vessel and the contents would become very cold.

You can use the same principle to keep the milk-bottle cold or to provide a cold drink of water. The apparatus consists of a small plaster-of-paris chest just large enough to contain two quart-size milk-bottles; it can be made by anyone who follows these instructions.

Inner and Outer Molds

Make a cardboard box or mold for the inside of the chest just 4½ by 9 by 10 in. (see Fig. A). This mold should be thick enough to hold the wet plaster in place without bending inwards. After laying out the card to the proper dimensions, cut out around the outlines and score lightly on the outside,



A cardboard box or mold is first made for the inside of the chest

so that the corners will be straight. Bend into box shape and paste strips of paper over the open edges to prevent the plaster from getting inside the mold.

Now make an outside mold of wood (see Fig. 2), tying it down on the bottom board to keep the plaster from running out under the mold. Fasten this mold together with screws, so that you may take it apart without breaking your casting when complete. After you have marked a line 3 in. from the top all around the inside of the outside mold, you are ready to make the casting.

How to Handle the Plaster-of-Paris

Place the cardboard inside mold or core (Fig. 1) in the center of the outer mold (Fig. 2), resting on four blocks at the corners, about 1 in. square and just 1½ in. high. Use a flatiron or other weight on top of the inner mold to keep it from floating away when you pour the plaster.

Have on hand a good supply of

$95 an Hour!

"Every hour I spent on my I. C. S. Course has been worth $95 to me! My position, my $5,000 a year income, my home, my family's happiness—I owe it all to my spare time training with the International Correspondence Schools!"

Every mail brings letters from some of the two million I. C. S. students telling of promotions or increases in salary as the rewards of spare time study.

What are you doing with the hours after supper? Can you afford to let them slip by unimproved when you can easily make them mean so much? One hour a day spent with the I. C. S. will prepare you for the position you want in the work you like best.

Yes, it will! Two million have proved it. For 28 years men in offices, stores, shops, factories, mines, railroads—in every line of technical and commercial work—have been winning promotion and increased salaries through the I. C. S. More than 100,000 men and women are getting ready *right now* with the I. C. S. help for the bigger jobs ahead.

Your Chance is Here!

No matter were you live, the I. C. S. will come to you. No matter what your handicaps, or how small your means, we have a plan to meet your circumstances. No matter how limited your previous education, the simply written, wonderfully illustrated I. C. S. textbooks make it easy to learn. No matter what career you may choose, some one of the 280 I. C. S. Courses will surely suit your needs.

When everything has been made easy for you—when one hour a day spent with the I. C. S. in the quiet of your own home will bring you a bigger income, more comforts, more pleasures, all that success means—can you let another single priceless hour of spare time go to waste? Make your start right now! This is all we ask: Without cost, without obligating yourself in any way, put it up to us to prove how we can help you. Just mark and mail this coupon.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 7669, SCRANTON, PA.

Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electric Lighting and Rys.
- ☐ Electric Wiring
- ☐ Telegraph Engineer
- ☐ Telephone Work
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Machine Shop Practice
- ☐ Toolmaker
- ☐ Gas Engine Operating
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREMAN or ENG'R
- ☐ STATIONARY ENGINEER
- ☐ Marine Engineer
- ☐ Ship Draftsman
- ☐ ARCHITECT
- ☐ Contractor and Builder
- ☐ Architectural Draftsman
- ☐ Concrete Builder
- ☐ Structural Engineer
- ☐ PLUMBING AND HEATING
- ☐ Sheet Metal Worker
- ☐ Textile Overseer or Supt.
- ☐ CHEMIST
- ☐ Mathematics
- ☐ SALESMANSHIP
- ☐ ADVERTISING
- ☐ Window Trimmer
- ☐ Show Card Writer
- ☐ Sign Painter
- ☐ Railroad Trainman
- ☐ ILLUSTRATING
- ☐ Cartooning
- ☐ BUSINESS MANAGEMENT
- ☐ Private Secretary
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Pub. Accountant
- ☐ TRAFFIC MANAGER
- ☐ Railway Accountant
- ☐ Commercial Law
- ☐ GOOD ENGLISH
- ☐ Teacher
- ☐ Common School Subjects
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ AUTOMOBILE OPERATING
- ☐ Auto Repairing
- ☐ Navigation
- ☐ AGRICULTURE
- ☐ Poultry Raising
- ☐ Spanish
- ☐ French
- ☐ Italian

Name
Present Occupation
Street and No.
City State

Canadians may send this coupon to International Correspondence Schools, Montreal, Canada

7-25-19

Are YOU Headed For The Scrap Heap

STRONGFORT
The Perfect Man

Thousands of men are suddenly dumped into the scrapheap of wornout humanity who hadn't the slightest idea, a week or two before they got their walking papers, that they were slated to be fired.

A weak, sickly, constipated, bilious, grouchy man never appreciates that his usefulness is nearly at an end, until the day comes when he's out of a job for good. WAKE UP if YOU are dragging yourself through your daily work, handicapped and hampered at every point by chronic ailments that are dragging you down into the great army of THE UNFIT. Your collapse will come some day with a bang—probably when you least expect it. Look the facts in the face—take stock of yourself—ACT, before it is too late, and

Make Yourself Fit

You can do it without any question, when you once appreciate the dangerous toboggan you are on and make up your mind to get off it for good and all. You can get rid of the constipation that is soaking your system with virulent poisons; you can free yourself from the digestive disorders that are making you feel like a human wreck, you can turn your watery blood into the rich, life-giving fluid that will build up your body and your brain, strengthen all your vital organs and make a virile MAN of you again—you can do it, if you WILL to do it, and go about it in Nature's way.

Don't take the wrong turning and waste your time and money in quick "remedies" and patent medicine dope. Nature never prepared a prescription or put up a patented powder. Your violation, perhaps unconsciously, of Nature's Laws, brought you to your present condition, and she alone, through her marvelous recuperative force, can restore the manhood you have lost.

Let Me Show You Nature's Way

I don't deal in drugs and dope. My life has been spent in studying out and experimenting with the forces that Nature has implanted in every human organism for the eternal betterment of the human race. No more wonderful power exists in all the world. Every physician and surgeon depends upon it; without the aid of Nature no treatment, no operation, could possibly succeed.

I built myself up into the strongest man in the world through Strongfortism — Nature's method of Remaking Men. Thousands of strong, able, successful men, former pupils of mine, owe their present abounding vitality, and the success it brought them, to that same method. Pupils of mine right now, in every part of the globe, are regaining each day the vigor and vitality they thought was lost forever.

Strongfortism

Strongfortism is simply a system of Living Life as Nature meant it to be lived; of taking advantage to the utmost of the wonderful forces she constantly exerts toward the rebuilding of wasted brain and body tissues and the restoration of lost vitality. Your present unfortunate condition may have been caused by early indiscretions or excesses of your own, it makes no difference; no matter how much of your energy has ebbed away, Strongfortism will help you, as it has helped other men, and set you on the right road toward renewed health and manly vigor. I have never known it to fail. I GUARANTEE to improve your condition 100 per cent, if you will follow my directions for a few months.

Send For My Free Book

"Promotion and Conservation of Health, Strength and Mental Energy" will give you all the facts about Strongfortism, and prove to you indisputably that Strongfortism will do for you what it already has done for thousands of other sickly, miserable men You'll find it interesting from first to last, because it treats of the most important thing in the world TO YOU. Send for it NOW. Don't delay — every day, every hour counts. Remember THE BOOK IS FREE. Fill out the coupon and mail to me with three 2c stamps to cover packing and postage and I will send with the book a special letter on the subject in which you are most interested.

LIONEL STRONGFORT
Physical and Health Specialist
1180 Strongfort Institute NEWARK, N. J.

---- CUT OUT AND MAIL THIS COUPON ----

Mr. Lionel Strongfort, Newark, N. J.

Dear Strongfort:—Please send me your book, "Promotion and Conservation of Health, Strength and Mental Energy," for postage of which I enclose 6 cents in stamps to cover mailing expenses I have marked (X) before the subject in which I am interested. (1180)

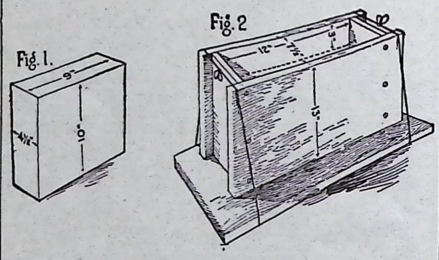
..Colds	..Deformity	..Nervousness
..Catarrh	..Insomnia	..Poor Memory
..Asthma	..Heartweakness	..Rheumatism
..Obesity	..Short Wind	..Poor Circulation
..Headache	..Flat Feet	..Skin Disorders
..Thinness	..Constipation	..Despondency
..Rupture	..Biliousness	..Round Shoulders
..Neuritis	..Torpid Liver	..Lung Troubles
..Neuralgia	..Indigestion	..Increased Height
..Flat Chest		

Name.....
Age ..... Occupation.....
Street.....
City..... State.....

plaster-of-paris, because, once you begin to mix and pour the casting, you will find no time to get more, since it dries very quickly.

Fill a large mixing-bowl half full of water, then stir the plaster in a little at a time until the mixture is fairly heavy but will run freely; then, after making sure that the mold is perfectly level, begin to pour the wet plaster. Repeat the mixing and pouring until the plaster reaches the mark you have made 3 in. below the top of the outside mold.

The casting you have just made is the ice-box of your refrigerator. Let the casting stand until the plaster is dry (about two days, for safety); then with your countersink bit, or with the end of a knife-blade, bore out four shallow holes on the top edge of the casting in each corner, to serve as register knobs on the bottom edge of the cover when complete. Now, with a little butter or lard, grease thoroughly



At the left is the box folded. At the right the completed chest, which keeps food cold without ice

the exposed top edges of the casting all around, taking care that the four depressions in the corners are well greased; remove the flatiron from the top of the inside mold; and continue the mixing and pouring until the casting reaches the top of the outside mold.

When this new section or cover is thoroughly dry, carefully remove the outside mold, and with an 8-in. bit or gimlet bore two holes down through the center of the cover for ventilation.

If the edges of the chest were properly greased the two sections of the casting should come apart with little difficulty, and you can then remove the cardboard center mold by breaking it up.

Set the refrigerator in the sink and let a gentle stream of water run on it, inside and out, until it is wet through. This is all the "ice" required, and one wetting should be sufficient for several days, the precise number of which you will be able to judge by experience. Place the milk or water in bottles inside, fit the cover on snugly, and you will be surprised to find how cold they will keep.

The device will be found useful in hot weather to keep liquids and eatables from spoiling for it keeps them cool not ice-cold. It can also be made in different sizes to suit individual by changing the form of the mold. Its cost will be amply repaid by decreased ice bills.—MORTIMER TESSIER.

DIAMONDS WATCHES ON CREDIT

Cased in Handsome Ring Box

SEND FOR FREE CATALOG

There are over 2,000 photographic illustrations of Diamond Rings, Diamond La Vallieres, Diamond Ear Screws, Diamond Scarf Pins, Diamond Studs, Watches, Wrist Watches; also our wonderful showy assembled Solitaire Diamond Clusters.

Diamonds Win Hearts

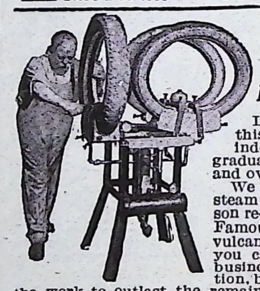
Loftis Perfection Diamond Rings

Each Diamond is specially selected by our diamond experts and is skilfully mounted in our famous Loftis "Perfection" 14-karat solid gold 6-prong ring, possessing every line of delicate grace and beauty.

$10 Down, $5 a Month, buys a $50 Ring.
$20 Down, $10 a Month, buys a $100 Ring,
$25 Down, $12.50 a Month, buys a $125 Ring.

Every Article in Our Large Jewelry Catalog is specially selected and priced **unusually low.** Whatever you select will be sent prepaid by us. **You see and examine the article right in your own hands.** If satisfied, pay one-fifth of purchase price and keep it; balance divided into eight equal amounts, payable monthly. Standard world-renowned watches on credit terms as low as $2.50 a month. Send for Catalog. LIBERTY BONDS ACCEPTED.

LOFTIS BROS & CO. EST'D. 1858
The National Credit Jewelers
Dept. L871 108 N. State St.
CHICAGO, ILL.
STORES IN LEADING CITIES



Big Profits in Vulcanizing

Little Capital Needed

Let us help you start in this profitable business and be independent. Many of our graduates make $3,000 a year and over.

We manufacture the Anderson steam vulcanizer and the Anderson re-treader and teach you the Famous Anderson Method of vulcanizing. With an Anderson you can get the cream of the business regardless of competition, because you can guarantee the work to outlast the remainder of the tire. We can show you that the Anderson machine and method does superior work at a cost of less than 10 per cent of that required for all other vulcanizers. This means satisfied customers and bigger profits.

We have established Anderson vulcanizing schools in thirty states for teaching the Anderson Method. The course requires 5 to 10 days and costs $20. If you buy an Anderson vulcanizer we not only return your $20 but pay you $2 per day expense money while you are learning.

We expect Anderson vulcanizers to do first class work and expect our students to make good in a business way. Their success is our success. *Therefore we do not sell an Anderson vulcanizer to any one who has not received our course of instructions.*

It costs you nothing to investigate this wonderful opportunity. Write today for full particulars and address of Anderson school nearest you *Print your name to avoid mistakes.*

ANDERSON STEAM VULCANIZER CO.
Williams Building Indianapolis, U. S. A.

Mend your Pots, Pans and Toys and Do All Metal Repair Work with

25c PER TUBE
TORCH $1.25

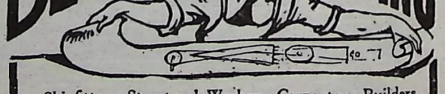
SOLDERALL
A PASTE THAT TURNS INTO METAL WHEN HEATED

A match will do it Requires no acid or soldering iron Joins or repairs wires, metals or metalware. Sold by hardware and electrical stores, or sent by us postpaid.

SOLDERALL CO., Dept. 7
129 Sussex Ave., Newark, N. J.
COMBINATION SET Tube and Torch Complete $1.50

USED BY U. S. AND ALLIED GOVERNMENTS IN WAR

BLUE PRINT READING



Shipfitters, Structural Workers, Carpenters, Builders, Mechanics, Plumbers and others can earn more money if they know how to read Blue Prints. By our method, we train you in a short time. Write for Catalog B. We also teach Drafting. Be a Draftsman! Earn big money. Draftsmen in demand. Books and tools FREE. Write for Catalog G.

COLUMBIA CORRESPONDENCE SCHOOL Est. 1904
Dept. M. Drexel Bldg., Phila., Pa.

Repairing a Steam Engine Under Difficulties

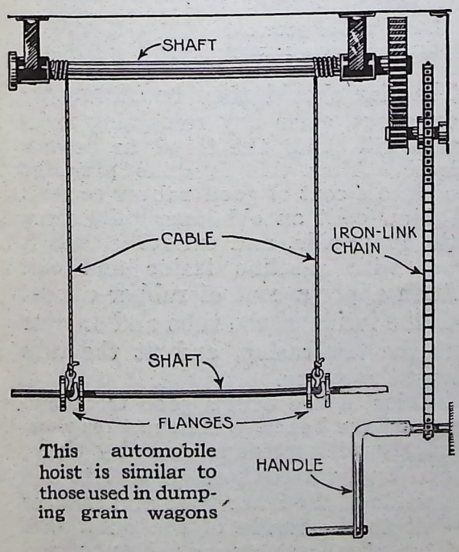
WHILE on a vacation in the Sierra Nevada mountains in California, I came upon a construction camp where the men were engaged in building a rock dam to impound the water from the winter snows for use in the gold-mines in the summertime. Their hoisting engine had broken down, and as the engineer was not a machinist, he was helpless.

I found that the connecting-rod was of the marine type, and that the two bolts on the crank end of the rod, which hold the crank brasses in place, were sheared off. This was probably due to starting the engine when there was water in the cylinder. The camp possessed a small forge, but no screw-cutting tools.

However, I determined to get the repair made somehow; so, after forging two new bolts, I clamped the threaded end of the broken bolt on to a new one, scratching each thread with the point of my knife to get the correct spacing. I then proceeded to cut the thread with a triangular saw file that happened to be in the tool-box of my automobile. By working carefully and filing at the pitch of the screw, I succeeded in threading two bolts in about four hours' time, and had the engine running again in less than six hours. The bolts were ¾ in. in diameter with about 1½ in. of thread.—M. L. LOWREY.

To Work on the Under Side of a Car

A WISCONSIN garage-owner has put into practice in his establishment a method of working on the



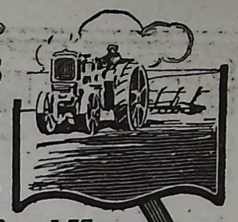
This automobile hoist is similar to those used in dumping grain wagons

under side of cars without having to get under them.

In order to do this he employs a hoist similar to that used for dumping grain wagons, with which he is able to stand the car on one end, or the other, to suit the particular job he has on hand at that time.

The hoist consists of a shaft geared back to a crank so that a load of

Learn Auto and Tractor Business



in 6 to 8 Weeks—Earn $150 to $400 a Month Come to the oldest school of practical training and learn best and quickest by the Rahe Practical Method. More than 22,000 men owe their success and prosperity to their training here.

Thousands of Calls for Rahe Trained Men

We were first to use real practical methods in teaching this business in all its branches and have developed this method farther and better than any other. Rahe trained men are better qualified to get the pick of waiting positions and better prepared to go into business for themselves. Garages and repair shops everywhere know the higher skill and ability of Rahe graduates. We always have more calls for men than we can supply.

Rahe Auto & Tractor School
World's Oldest and Greatest

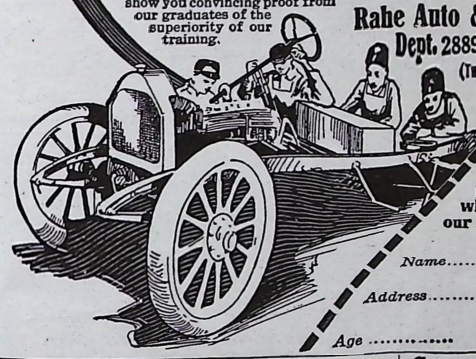
Twice more equipment and twice more floor space used in daily actual practice than any other school in America. Plenty of room for individual training. You start right to work on real automobiles, trucks and tractors the day you begin and learn quickly under guidance of Master Mechanic Instructors.

Every man 16 years and older, can easily learn this big paying business here. Specialized instruction in all departments, including largest and best arranged Live Motor and electric starting and ignition departments. Enter any time. No previous experience or special education required. No tools or "extras" to buy.

Low Tuition Rate Now
Special offer for Life Scholarship in our complete course to those who write now, especially to former soldiers.

Send For Proof—
Write for FREE 68-page Book. Let us show you convincing proof from our graduates of the superiority of our training.

Rahe Auto & Tractor School
Dept. 2889 Kansas City, Mo.
(Two Blocks from Union Depot)



Mail this Coupon Today for Special Tuition Offer with Big 68-page Book showing opportunities everywhere and proof of our graduates' success FREE

Name.....
Address.....
Age..... Occupation.....

AGENTS 500% PROFIT

N Gold and Silver Sign Letters
For store fronts, office windows and glass signs of all kinds. No experience necessary. Anyone can put them on and make money right from the start.
$30.00 to $100.00 a Week!
You can sell to nearby trade or travel all over the country. There is a big demand for window lettering in every town. Send for Free Samples and full particulars.
Liberal Offer to General Agents
METALLIC LETTER CO., 400 N. Clark St., Chicago

SEND FOR THESE BUNGALOW BOOKS

Plan FUTURE HOMES Now with ECONOMY PLANS of CALIFORNIA STYLES
—noted for comfort, beauty and adaptability to any climate.
"Representative Cal. Homes" 50 Plans, $3,750 to $12,000—$1
"The New Colonials" 55 Plans, $3,000 to $20,000—$1
"West Coast Bungalows" 60 Plans, $1,800 to $4,500—$1
SPECIAL OFFER. Send $2.50 for all 3 above books and get book of 75 Special Plans, also Garage folder FREE
EXTRA—"Little Bungalows" 40 Plans, $750 to $3000—50 cts.
Money back if not satisfied
E. W. STILLWELL & CO., Architects, 470 Calif. Bldg., Los Angeles

$289 Earned IN LESS THAN A MONTH

A New Business—Big Business
A Business to Enthuse Over—The "Ideal" Lawn Mower Sharpener
A new invention that sharpens lawn mowers scientifically—perfectly, wonderfully; does the work as nothing else can.

Mr. Francis says: "I have sharpened 289 Lawn Mowers so far this month, and I intend to make it 400." He charged $1.00 per mower. If he sharpened the full 400 mowers, he earned $400 in One Month. "IDEAL" paid for itself in less than a week.

A GOOD BUSINESS PROPOSITION
Wm. D. Troutner, Ill., says, "I have preference of Lawn Mower Sharpening from other towns 12 to 20 miles around." You can have the same kind of business.

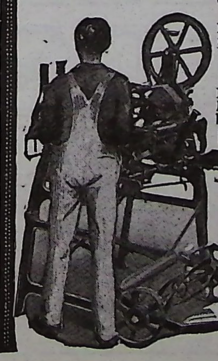
Earns $22 One Day
Elmer Smiley, Albia, Ia., writes, "I have sharpened 22 lawn mowers today."—$22.00 daily earnings is some money.

E. W. McCormick says: "Have had "Ideal" only 15 days—sharpened 117 mowers, plenty of work ahead." That is making
$117 in Two Weeks

You Start Now No town too small. Lawn Mowers all dull—owner doesn't know where to get it sharpened. Mowing the lawn dreaded because of dull or improperly sharpened mower. Lawn mowing healthful, invigorating and pleasant when mower is "Ideally" sharpened. You do the work scientifically—you are in big demand.

Lawn Mowers Sharpened to Razor Edge
People glad—owners delight in mowing lawn with mower sharpened on an "Ideal." Mower runs light—click—click—click—and the grass is cut. Build permanent business for yourself. Start now!

Write Today GET OUR PROPOSITION
FREE—we have detailed illustrated book to send you. Write today for our proposition.
The FATE-ROOT-HEATH CO.
Department 37
Bell & High Sts.
Plymouth, Ohio



Use This—Mail It Today!
The FATE-ROOT-HEATH CO.
Bell & High Sts., Dept. 37 Plymouth, Ohio
Send me at once details of your complete proposition.
Name _____
Address _____

PATENTS TRADE-MARKS AND COPYRIGHTS

Before disclosing an invention, the inventor should write for our blank form "EVIDENCE OF CONCEPTION." This should be signed and witnessed and if returned to us together with model or sketch and description of the invention, we will give our opinion as to its patentable nature.

Our Illustrated Guide Book, HOW TO OBTAIN A PATENT, sent Free on request. Contains full instructions regarding Patents, Trade-Marks, Foreign Patents, Our Methods, Terms and 100 Mechanical Movements illustrated and described, Articles on Patent Practice and Procedure, and Law Points for Inventors.

Highest References *Prompt Service* *Reasonable Terms*

FREE COUPON!

VICTOR J. EVANS & CO., Patent Attorneys

New York Offices 1001 Woolworth Bldg. *Philadelphia Offices* 135 S. Broad Street *Pittsburgh Offices* 514 Empire Bldg. *Chicago Offices* 1114 Tacoma Bldg.

Main Offices: 760 9th Street, N. W., WASHINGTON, D. C.

GENTLEMEN: Please send me FREE OF CHARGE your Book as described above.

NAME..... ADDRESS.....

PATENTS and Trade Marks

Send sketch or model for actual search and report. Write for Booklet of instructions on patent practice and procedure. Prompt personal service....

Geo. P. Kimmel
Patent Lawyer
39-D Loan and Trust Building, Washington, D.C.

PATENTS

Free Book on Patents

Before applying for a patent write for a Free Copy of our book "How to Obtain a Patent," which contains valuable information and advice to inventors. It tells how to secure Patents. Send a model or sketch of your invention for our "Evidence of Conception" form and our opinion of its patentable nature—Free. Twenty years' experience in patent matters.

Write today for your FREE BOOK.

TALBERT & TALBERT
Patent Lawyers
4622 Talbert Bldg., WASHINGTON, D. C.

PATENTS PROCURED and TRADE-MARKS REGISTERED

Twenty Years' Experience. Instructions and Terms on request.

ROBB, ROBB & HILL, Attorney at Law
Specializing in Patent and Trade-mark Practice exclusively
840 McLachlen Bldg., Washington, D. C. 1336 Schofield Bldg., Cleveland, Ohio.

PATENTS

TRADE-MARKS COPYRIGHTS

Send for our free book of patent information

Beale & Park 1416 F St., Washington, D. C. 16 S. Broad St., Philadelphia, Pa.

PATENTS

Write for free booklet

Terms Reasonable Highest References Best Results

Send model or drawing for preliminary examination and report as to patentability

ALL BUSINESS GIVEN PROMPT AND PROPER ATTENTION

WATSON E. COLEMAN, Patent Lawyer, 624 F St., Washington, D.C.

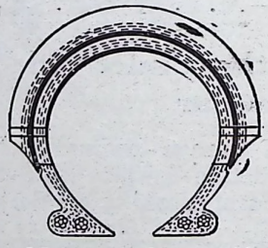
several tons can be easily lifted. Cables carrying hooks are wound upon the shaft as the crank is turned. A piece of 2-in. gas-pipe, padded and equipped with flanges, is slipped through the spokes of both front or both rear wheels as the case may be, and the hooks attached. Padding prevents the paint from being marred and flanges keep the hooks from sliding either way on the pipe.

The device is simple, durable, and very easy to install; and with any ordinary car may be hoisted to the desired position in three minutes. When the hoist is attached to the rear end of the car the car may be raised to an angle of ninety degrees. The front end may be lifted to an angle of sixty degrees or more, depending upon the shape of the rear fenders.—PAUL L. FETHERSON.

A Novel Way to Retread an Automobile Tire

ALTHOUGH many people retread their own tires the process is generally looked upon as a waste of time because the job is so often unsuccessful. The process here described has proved satisfactory, and by following it carefully a large amount of tire money will be saved.

Take a tire with a badly worn tread. It should have good fabric and show no signs of rim-cut. The rubber must be removed from the fabric to within 2½ in. of the bead. An old rasp will be found useful in removing the rubber. Rough up the fabric a bit to give a good hold for the cement.

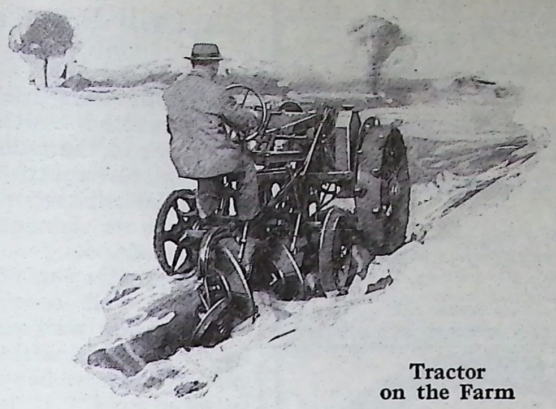


Make use of your old tires and save money

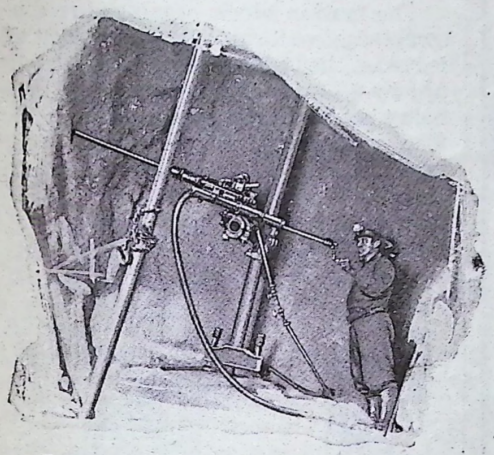
The tire should then be thoroughly dried out, since any remaining moisture will cause the tread to become loose. After this is done give the surface a coat of good rubber cement.

Now split an old inner tube along the inner side, and carefully wash it out with gasoline inside and out. Then apply a coat of rubber cement to the inside of the tube and another to the tire casing, and fit the tube over the casing.

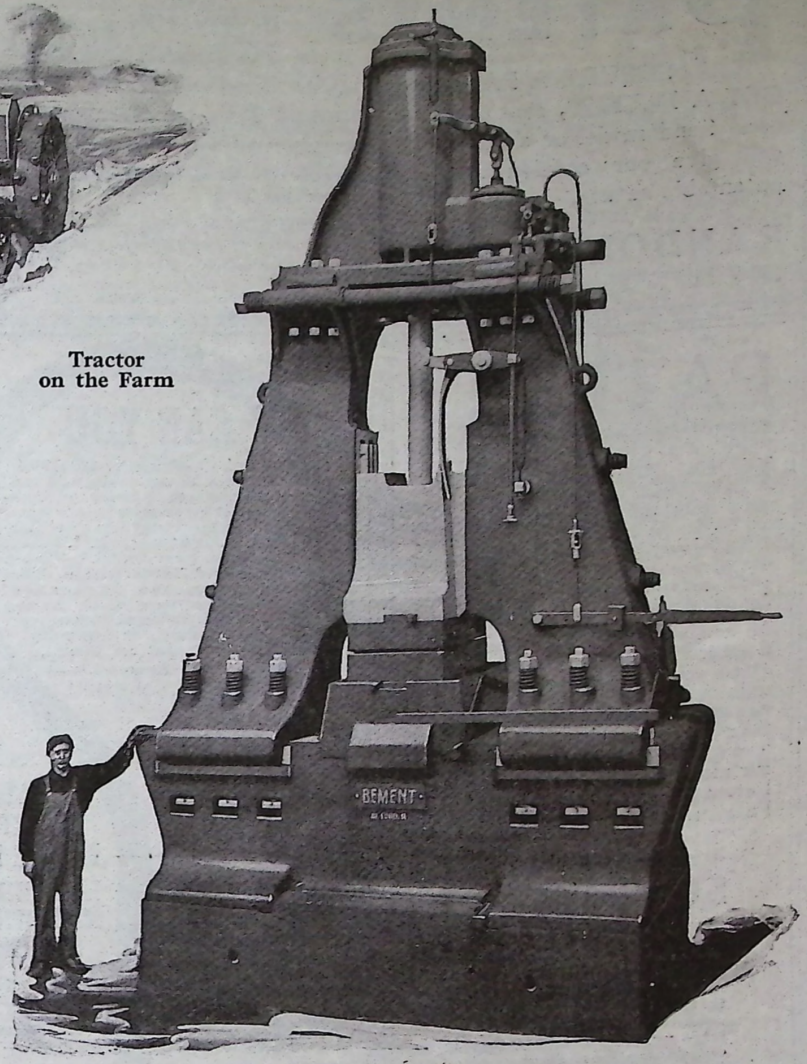
Select a tire with a good tread and cut off the beads, wash the tires thoroughly with gasoline and dry them, and apply a coat of cement to the outside of the inner tube and another coat to the inside of the outer tire. Then fit the tire over the tube, and place both upon a wheel, pump up and allow to dry. You may then remove and sew it along the edges as shown in the sketch. In this way you can utilize old tires that would otherwise be thrown on the junk-pile. When they wear out the tire underneath is still brand-new. Try the suggestion—it will save you money.—S. E. GIBBS.



Tractor on the Farm

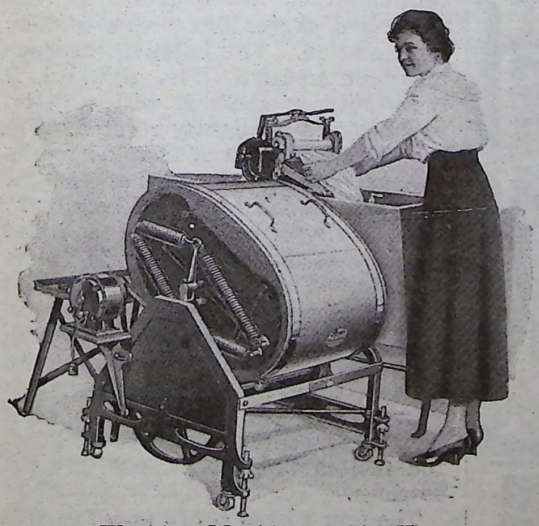


Pneumatic Rock Drill in the Mine



The Drop Hammer in the Factory

Adding Machine in the Office



Washing Machine in the Home

Machinery
and Inventive Genius

Production of the clothes you wear, the food you eat, the modern comforts of the home, the labor-saving aids for the office, *the very money you use*, all involve the employment of wonderfully constructed and productive machinery.

The immense value of machinery to thousands of factories, farms, mines, offices, homes — *to hundreds of different and widely diversified industries everywhere*, cannot be computed.

New and useful machinery, of tremendous importance to all lines of industry is continually being invented, patented, protected and put into profitable operation.

The proper procedure in obtaining a patent for an invention is absolutely necessary in order that you may realize the profits that your ideas may be worth.

To the Man With an Idea

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea free on request. Write today.

RICHARD B. OWEN, PATENT LAWYER

6 Owen Building, Washington, D. C. **2776D Woolworth Building New York City**

PATENTS

IF YOU HAVE AN INVENTION *and* DESIRE TO LEARN HOW TO SECURE A PATENT, send for Our Guide Book, HOW TO GET A PATENT, sent Free on request. Tells our Terms, Methods, etc. Send model or sketch and description of your invention and we will give our opinion as to its patentable nature.

NAME.....
STREET.....
CITY.....STATE.....

RANDOLPH & CO.
130 F St., N. W., Washington, D. C.

PATENTS

IF YOU HAVE AN INVENTION which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand-Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to **Patents, Trade Marks, Foreign Patents, etc.**

If you are a reader of the

SCIENTIFIC AMERICAN

you are probably aware of the fact that it has a special appeal to the inventor. Each issue contains a description of a large number of recently patented inventions. Pending patent legislation as well as the most recent rulings of the Patent Office and the courts are considered in its columns.

MUNN & CO.
SOLICITORS OF PATENTS
683 Woolworth Building, New York
624 F Street, Washington, D. C.
Tower Building, - Chicago, Ill.

CAN YOU

think of a simple, practical idea that will fill one of the many requests we have on file for new inventions? It may mean a fortune for you. Thousands of things are needed RIGHT NOW. YOUR brains can help. Send today for our great new book—**"Inventions and Trade Marks, Their Protection and Exploitation"** and learn more about making money from ideas than you ever knew before. It tells many things that are wanted, too. A postal will do—it is free.

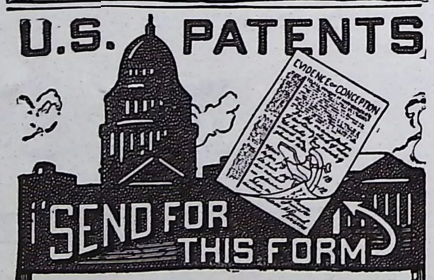
We help our clients, without charge, to get the dollars out of their ideas—having facilities none others possess.

Advice free.
Don't delay—get the book at once.

AMERICAN INDUSTRIES, INC.
201 Patent Dept., WASHINGTON, D. C.

PATENTS ADVERTISED For SALE FREE In INVENTION And MANUFACTURING SUPPLEMENT.

Published for the man with an idea. Send for free sample copy. One year's subscription 50c.



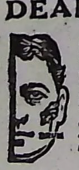
DON'T LOSE YOUR RIGHTS
TO PATENT PROTECTION

Before disclosing your invention to anyone send for blank form **"EVIDENCE OF CONCEPTION"** to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish the same before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request. Ask for them,—a post card will do.

PATENTS AND TRADE MARKS
LANCASTER & ALLWINE
274 Ouray Bldg.
WASHINGTON, D. C.
Originators of forms "Evidence of Conception."

"The Book for Inventors and Manufacturers"
SIXTH EDITION
By return mail FREE.
Write LACEY & LACEY
Dept. M Washington, D.C.

DEAFNESS IS MISERY



I know because I was Deaf and had Head Noises for over 30 years. My invisible Antiseptic Ear Drums restored my hearing and stopped Head Noises, and will do it for you. They are Tiny Megaphones. Cannot be seen when worn. Effective when Deafness is caused by Catarrh or by Perforated, Partially or Wholly Destroyed Natural Drums. Easy to put in, easy to take out. Are "Unseen Comforts." Inexpensive. Write for Booklet and my sworn statement of how I recovered my hearing.

A. O. LEONARD
Suite 301, 70 5th Avenue • • New York City

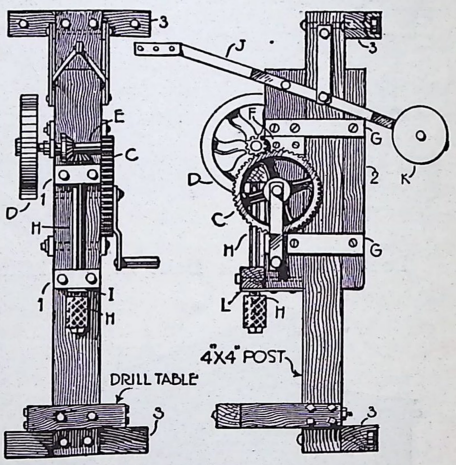
The Prophylactic Tooth Brush
A clean tooth never decays—the Pro·phy·lac·tic keeps teeth clean

A Drill-Press and How to Make It

THE homemade drill-press illustrated herewith is one that will actually do the work of the manufactured article, drilling holes up to ¾ in. in diameter. It can be constructed by any one who possesses an elementary knowledge of the use of tools.

The greater part of the press is made of wood, well seasoned oak being the best for the purpose. All numbered parts in the illustrations are made of wood, but cast bearings may be substituted for l, l, if desired.

The motion block bearings are constructed of well seasoned oak. To this is bolted the two bearings l, l, with two 5¾-by-⅜-in. machine bolts, the nuts being set in pockets as shown at *H*. The bearing *E*, forged from ¾-in. iron, is also bolted to the motion block,



The whole machine is bolted to a strong post so that it will carry the motion block to its highest point

being countersunk into the wood at *A A*. At *B* a ¾-in. hole is bored into which is fitted a ¾-by-7-in. machined bolt to act as a bearing for the drive wheel *C*.

Shafting ¾ in. in diameter is used throughout. The gears, with the exception of *C*, are fastened to their respective shafts by means of 1-in. pins, riveted. The holes in the gears are countersunk. The flywheel *D* is fastened to shaft *E* with a ¼-in. pin, being only slightly riveted. The end thrust of shaft *E* is taken up by spacing washers placed between the hub of *D* and the arm of bearing *E*. The bearing blocks l, l are drilled for shaft *B*, the hole being 1¼ in. in diameter. These holes are roughened and made larger in the center than at either end. A few pins of iron with rough heads are also driven into the walls of these holes. The shaft *E* is then put in place, lined up so that it is exactly perpendicular to the drilling, and molten babbitt poured into the bearings.

The four pieces *C* are now fastened to the motion block. These are made of ½-in. iron and are fastened to guide block 2. All parts subjected to the reciprocating motion of this block

should be carefully shod with ⅛-in. sheet iron which is fastened to the wood with wood screws, countersunk—or angle-irons may be put on all corners subjected to motion. This is not shown in the drawings.

Any standard drill chuck may be used at *H* or a chuck from an old carpenter's brace may be used; in fact this is to be preferred because square shank drills are much cheaper than other kinds.

Between chuck *H* and thrust bearing *I* are placed several machined spacing washers. The thrust bearing is fastened into place after shaft *I* is in position.

The drill is fed by means of a lever *J*, which is made of 3/16-in. iron in the shape shown. On the back end is placed a counter-balance *K* to restore the motion block to its original position after drilling.

The fulcrum rods *L* are made of ¾-in. iron about 9 in. long. There are two of these, one on each side, and they are fastened at the top end by a bolt, and so secured that they move freely as illustrated by the dotted lines. All the feed lever parts should be neatly adjusted, washers being used where spacing is necessary. The whole machine is bolted to a strong post 4 in. square by blocks 3-3. Counterbalance *K* is then fastened on 3 behind the plank, to which the machine is bolted so it will easily carry the motion block to its highest position.

The drilling table is strongly made from oak and is fastened to the drill post by six bolts. Under gear wheel *C* a large washer is placed and a suitable handle bolted on.

The gears used in the above-described machine were taken from an old washing-machine.—W. L. STEVENS.

Why It Is Your Automobile Radiator Boils

THERE are three principal causes for the boiling of the water in a motor radiator and the consequent necessity and annoyance of frequently replenishing it.

The fan belt slips, the pump does not work, or the ignition system is not correctly timed. If, after assuring yourself that the fan belt is tight and the pump works properly, the heating continues, you may be practically certain that the magneto is not timed right. The spark is too slow. It comes slightly after the point of maximum compression, with a resultant loss of speed and power, an excessive consumption of gasoline and rapid heating of the water in the cooling system.

Unless you have an instruction book describing very carefully the process of retiming an ignition system, you had better have this done by an expert at some garage. Like a skilled physician he can instinctively feel the "pulse" of your motor and diagnose its ills and cure.—FLOYD L. DARROW.

3¢ Worth of Miracle Motor-Gas Equals a Gallon of Gasoline

A Wonderful Chemical Discovery That Increases the Power of Gasoline Fully One-Third

Miracle Motor-Gas is a big money saver for the motorist. You will be surprised, then gratified at the way it multiplies the power of your gasoline. Hundreds of our customers who have made many tests tell us that Miracle Motor-Gas gives from 15 per cent to 40 per cent more mileage from every gallon of gasoline. Many claim even greater results than that.

Guaranteed Absolutely Harmless

If used according to directions Miracle Motor-Gas is guaranteed to increase mileage from 15 per cent to 40 per cent, eliminate and prevent carbon deposits, greatly reduce fuel costs and make engine run more smoothly.

We guarantee it to contain no acids, alkali, camphor, ether or other chemicals which could possibly injure any part of the motor or other mechanism of the finest car. We further guarantee to make good to any purchaser, any injury to his automobile caused through the use of Miracle Motor-Gas.

What Miracle Motor-Gas Will Do

One hundred Miracle Motor-Gas Tablets will make 100 gallons of gasoline do the work of 133 gallons; will give you an increased power and mileage the equivalent of 33 gallons of gasoline. Figuring on this basis, the following shows what a big saving can be made by using Miracle Motor-Gas Tablets:

If from 100 gallons of gasoline you get 1500 miles, the addition of 100 Miracle Motor-Gas tablets will increase that mileage to 2000 miles. Think of it—500 miles for one dollar.

And here's the big thing—Miracle Motor-Gas contains no acids, alkali, camphor, ether or any other chemicals that could possibly injure any part or parts of the motor or other mechanism.

It will eliminate carbon and make your motor run better in every way. Miracle Motor-Gas is needed the year 'round, but it is especially needed in winter for it insures easier starting and quicker pick up.

Thousands of Motorists Are Using Miracle Motor-Gas

Motorists in every section of the country have put Miracle Motor-Gas to the severest of tests with the result that they are re-ordering it and recommending it to their motorist friends.

Our files are actually crowded with unsolicited letters endorsing this great discovery. Many of them state our claims are far too modest; some going as far as to say that Miracle Motor-Gas saves them 50 per cent in gasoline.

After one trial you will be just as enthusiastic as the thousands of other motorists. You are losing money every day you delay the trial.

What Users Say About Miracle Motor-Gas

"We can recommend it to do all you claim for it. We are saving on gasoline bills fully 40 per cent and believe we can do better than that as the carbon is all gone; that alone is worth more than the cost to say nothing of the additional power and speed we get." J. S. NEELAND.

"I was very doubtful about the ability of your Miracle Motor-Gas to do what you said it would do. After using it I find the car works much smoother, the amount of gasoline is very much less and the carbon deposits in the engine are a thing of the past, which fact alone more than pays the cost of your product. As you know, I was a hard customer to convince but I have been thoroughly convinced and satisfied." DR. D. W. MCKENNA.

"I have tried Miracle Motor-Gas in two makes of automobiles with the following results: An increase of mileage with the Hupmobile of 45 per cent; Studebaker an increase of 44 per cent, and carbon was entirely eliminated from both machines." H. E. DAUB.

Easy to Sell! Profits Come Fast! One Man Made $210 in One Day

Once you get started selling Motor-Gas you will be surprised to find how easy it sells. Just show our Guarantee to some auto owner and ask what he would give for a product that would do what we guarantee it to do. Read again these letters from users,—they tell the story. We have hundreds more just like them. As soon as auto owners find what Miracle Motor-Gas will do, they scramble to get a supply. You don't have to sell it. You only need to convince a few—the others will follow. Sales come so fast that you can't help but make money. One agent felt like pinching his own arm to see if it was really himself who was making so much money. It isn't at all unusual for our men to make $10, $25 and $50 per day. Some do better than that.

These are extracts from actual letters received from sales agents. They tell the story better than we can. Here's what O. V. Darling wrote us: "Made a test of Miracle Motor-Gas today on a 103-mile trip. Had two Fords. The one with Miracle-Gas used only 3½ gallons of gasoline; the one without Miracle-Gas used 7 gallons." As a result of this test he sold Miracle Motor-Gas like hot cakes. In one day he sold enough to make a clean profit of $210. We have his letter to that effect.

Next comes this letter from Dave Ison: "My whole heart and soul are in this work. The Commercial Club of 4,000 members is boosting for me. Everyone is well pleased. Have two more men working for me Send me 800 more packages by express. I can't afford to be waiting for goods. Sold 90 packages yesterday." (That's over $60 profit.)

Agents Wanted Everywhere—300% Profit

One of the greatest money-making opportunities ever dreamed of is offered you right now. Live, hustling sales agents are wanted to sell Miracle Motor-Gas in every town and country of the United States. Think of the millions of car owners and every one a good prospect.

Practically every auto driver will buy when once you have explained what Miracle Motor-Gas will do. It is one of the biggest money-makers you can find. Your field is unlimited. There are thousands of autos all around you and you can help to make every one of them run more efficiently with Miracle Motor-Gas.

GET BUSY! DON'T WAIT!

Don't make the mistake of being a doubter and losing the opportunity. Our guarantee protects you. Or, better still, if you order two packages at the 50c trial price, and after testing them you aren't satisfied, send back the unused goods and get your dollar back. Miracle Motor-Gas is a proven proposition. It has demonstrated what it will do and now we want hundreds more good live agents to sell it. So get busy—get your oder to us at once and tell us what territory you want. But you'll have to act quickly. Better write us by return mail. Wire if you want terms for exclusive rights in your State.

CHAS. A. BUTLER & CO. 163 Butler Building Reference: Home Savings Bank, Toledo Toledo, Ohio

REXO Mounting Corners

for Mounting Photoprints, Postcards, etc., in Albums and on Mounts.

No Paste Required
Artistic, Permanent
Pkg. of 100, 10c at Your Dealers
BURKE & JAMES, INC
CHICAGO NEW YORK
Rexo Cameras, Films and Supplies

Deafness

Perfect hearing is now being restored in every condition of deafness or defective hearing from causes such as Catarrhal Deafness, Relaxed or Sunken Drums, Thickened Drums, Roaring and Hissing Sounds, Perforated, Wholly or Partially Destroyed Drums, Discharge from Ears, etc.

Wilson Common-Sense Ear Drums

"Little Wireless Phones for the Ears" require no medicine but effectively replace what is lacking or defective in the natural ear drums. They are simple devices, which the wearer easily fits into the ears where they are invisible. Soft, safe and comfortable.

Write *today* for our 168 page FREE book on DEAFNESS, giving you full particulars and testimonials.

WILSON EAR DRUM CO., Incorporated
419 Inter-Southern Bldg. LOUISVILLE, KY.

Army Auction Bargains

Tents	$4.25 up	C. W. revolvers	$2.65 up
Saddles	4.65 up	Army Haversacks	.15 up
Uniforms	1.50 up	Knapsacks	.75 up
Teamharness	26.85	Army Gun slings	.30 up

Spring. Rem. cal. 30 single shot rifle for model 1906 cartridges, $7.77 Ball cart. $3.50 per 100 15 acres Army Goods. Large illustrated cyclopedia reference catalog—428 pages—issue 1920, mailed 50 cents. Now Circular 10 cents

FRANCIS BANNERMAN SONS, 501 Broadway, New York

HOME STUDY (28th Year)

Courses in more than 40 subjects are given by correspondence.

Address

The University of Chicago (Div. 28) Chicago, Ill.

DRIVER AGENTS WANTED

116-inch Wheel Base

158-inch Spring Suspension

5-Pass. Touring

To drive and demonstrate 1920, 4-cyl., 37 H. P. BUSH Car—Timken Bearings—Willard Batteries—2-Units Str. & Ltg.—Full Floating Axel. Write at once for the best Automobile Offer in existence—don't wait—prompt shipments. Money-back guarantee.

BUSH MOTOR CO., Address J. H. Bush, President, Dept. C111 Bush Temple, Chicago, Illinois

$3 AND a month $4 WILL BUY

A Beautifully Reconstructed

TYPEWRITER

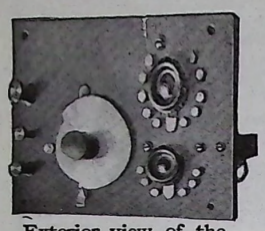
With Every Modern Writing Convenience

WRITE TODAY FOR ILLUSTRATED CIRCULAR
Explaining Try-Before-You-Buy Plan
HARRY A. SMITH, 306-218 North Wells St., Chicago, Ill.

For the Radio Experimenter

A Simple Undamped-Wave Receiving Set for the Amateur

WITH the increasing number of undamped stations comes a desire on the part of every radio amateur for a set suitable for continuous wave reception. But the cost of a long-wave coupler and several variable condensers usually puts this out of the possibilities of the average radio experimenter. Here, however, is a set inexpensive as to first cost, and requiring but one inductance and one variable condenser.



Exterior view of the receiving set complete. All parts homemade

The core for the inductance is turned out of hard wood to the dimensions shown in Fig. 1. It is then wound with 1,000 turns of No. 32 single-cotton-covered wire. Two hundred turns are wound in the first slot, taps being taken off at every twenty turns. Eight hundred turns are then wound in the two remaining slots (400 turns per slot) with taps at every 100 turns.

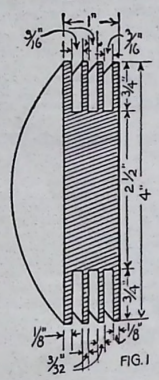


FIG. 1

Dimensions for the inductance coil of the set

The first set of taps are connected to the eleven contact studs of the switch represented by the lower of the three arrows in Fig. 2. The other sets of taps (those of 100 turns) are connected with the nine studs of the middle arrow. The winding should be given a layer of tape, and shellac used freely on all parts.

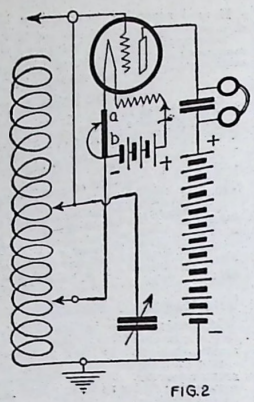


FIG. 2

Wiring diagram used in hooking up the parts

The diagram of connections is given in Fig. 2. The coupling between the plate and grid circuits is controlled by the two arrows just mentioned. The variable condenser determines the frequency of the local oscillations. It should be of the 43-plate type, and have a capacity of .00095 or .001 Mfd. Note that no grid condenser is used.

The grid is held at a definite negative potential by the resistance drop over "ab." This is a short strip of German silver wire whose length is varied until a position is found for best oscillation. Once made, this adjustment is permanent for a given vacuum tube. The inductance and condenser may be mounted in a small case and used with a purchased audion cabinet. The front board of such a case is shown in the illustrations herewith. All the materials used are easily within the reach of any amateur. At no place is the construction difficult nor the making of the various parts at all complicated. By reading the foregoing and carefully studying each diagram and illustration everything will become clear and the radio amateur will have no trouble in either constructing or wiring it together.—E. J. STERBA.

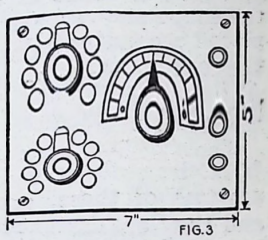


FIG. 3

Dimensions of the front panel as actually made

Clearing Up the Radio Patent Situation

ANNOUNCEMENT has recently been made that the Marconi Company and the radio interests of the General Electric Company have been combined in a new organization to be known as the "Radio Corporation of America."

This means that the patents of both will be utilized to the limit. The Marconi Company owns the Fleming valve patent and others of value, while the General Electric Company has done a great deal of work on vacuum tubes and related apparatus. It has also developed the Alexanderson high-frequency alternator, a contrivance originally fathered by Fessenden.

One of the principal reasons back of the General-Electric-Marconi merger was the fact that about 18 per cent of the Marconi's capital stock was owned in England. The Radio Corporation now acquires that stock, along with other assets, making the new company an all-American concern.

The Western Electric Company has acquired de Forest patents, and has many of its own. Thus these two concerns and the International Radiotelegraph Company, which is a patent-holding organization, promise to be the three big rivals in the radio field very shortly. The Navy Department owns the Federal Electric's arc system, in itself a very valuable holding.

The complicated patent situation that grew out of the war is gradually sorting itself out.

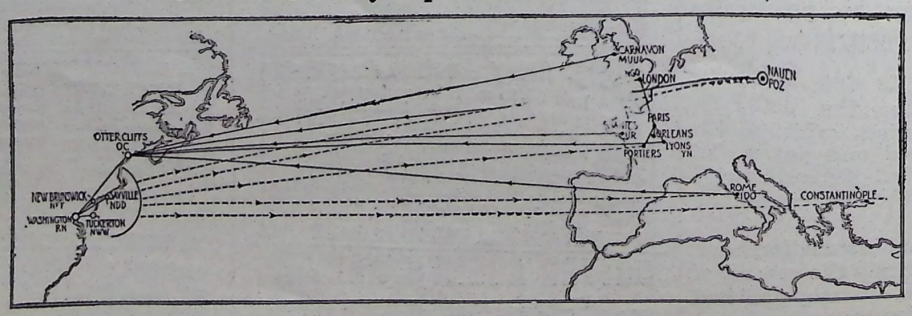
A World-Wide Experiment in Radio Transmission

THE eclipse of the sun by the moon on May 29, 1919, offered an unusual chance to study the effect of daylight and darkness on the intensity of radio signals. The British Association of Science arranged for certain stations to transmit and others to receive.

It appears that on the whole transmission was best just before, or during, the passage of the moon's shadow between the receiving station and the transmitting station. The moon's shadow traveled from South America at sunrise to the eastern coast of Africa at sunset, moving with enormous speed near the ends of its path.

The most striking results were obtained by the French stations of Meudon and Rousillon, near Lyons, which could hear Ascension only while the eclipse was in progress.

How the Navy Operates Its Stations



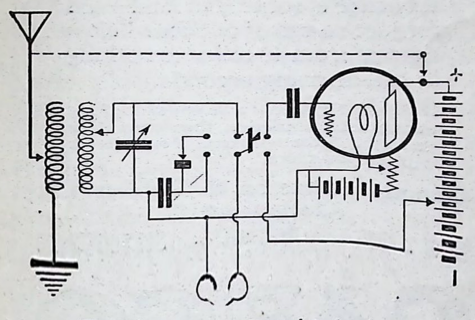
The black lines show messages coming from Europe to the Otter Cliffs, Maine, receiving station. Messages are relayed over and wires to Washington by automatic machines. Washington replies by working the Sayville, New Brunswick, or Tuckerton stations through remote control. In this way the whole situation is under instantaneous control of the Washington operators

Switch from Valve to Crystal at Will

A SIMPLE and efficient method of connecting the receiving tuner to either a valve or crystal detector requires but one switch for the operation, enabling a radio experimenter to have both types of detector in service, using a crystal for general work, and keeping the valve for more important receiving.

Ordinarily this idea necessitates the use of two or more switches, or, where one switch may have been used, causes some loss through dead-end effects.

The switch for the proposed circuit may be of the ordinary double-pole, double-throw type, as shown in the diagram. Preferably, though, it is of



Experimenters possessing both a crystal and tube will find this circuit a very convenient one

the kind known as a "pole-changer," as this may be built on the front of the receiving cabinet in a space about an inch square.

The "pole-changer" has two levers, connected by an insulating bridge carrying the handle. At the rear are two contacts, each connected to one of the levers. Each lever slides over two contacts at the front. These can be made of six old-type switch points, two small strips of brass, and a piece of hard rubber or bakelite (for the insulating bridge and handle).

The whole is then set on the front board of the cabinet with all connections completed on the rear of the board.

For continuous wave receiving on the valve, all that is necessary is to run a lead from the "aerial" post of the tuner to the plate lead—producing the well known Chambers circuit. By having a small single-pole switch placed as close to the plate lead of the valve as possible, undamped waves up to the full wave-length of the tuner may be received when this switch is closed. The position of this added lead is shown by the dotted line in the drawing.

A cabinet receiving set, equipped with valve and crystal detectors, using this circuit makes an ideal receiving outfit. Amplifying valves may be added, as in other valve circuits, and on the crystal side other crystals or a potentiometer may be connected. Radio experimenters in general may find other advantages.—GEO. A. WOLF and CHARLES E. PEARCE.

Learn Wireless
By Mail in Few Weeks

CALLS Coming in Steadily for National Radio Institute Graduates From All Parts of the Country. Four Concerns Guarantee to Take All Operators We Can Furnish.

Commercial Radio has arrived and many attractive positions are now open in the commercial land radio service, merchant marine, railroads, radio supply factories, lake and ocean steamship lines, telegraph companies and aerial mail service. We are now receiving requests for more National Radio Institute graduates than we can furnish.

Salaries Up to $350 a Month

With our help you can quickly qualify for first grade government license and good position paying you approximately $225 a month to start. Many of our students secure positions before completing the course, because it is based on actual practice and teaches what is needed to make a big success of wireless work. There are splendid opportunities for promotion to Radio Mechanic, Electrician, Government Inspector and Radio Engineer, paying as high as $350 to $400 a month. (Civil Service pays as high as $4,800 a year.) No previous training or experience is necessary to study wireless. You can learn wireless the National Radio Institute way in approximately three months by mail, right in your own home.

Get Your Instructions From The Nation's Capital

(Our Course Is Endorsed by the United States Government Officials)

The National Radio Institute, established in 1914, was the first in America to successfully teach wireless by mail. It is headed by authorities who have been closely allied with government training of students. The work is under direction of J. E. Smith, E.E., formerly director of the Radio Department, Howard University, and E. R. Haas, formerly of the Radio Division of Yale University, assisted by a competent corps of trained instructors and lecturers. We now have hundreds of students throughout the world. Our location in the Nation's Capital, together with the standing of our officers and their wide acquaintance among government officials connected with Wireless activities, places us in position to give our students the best instructions obtainable and to be of the utmost help in assisting them to secure good paying positions.

Travel If You Want To

If you want to travel and see the world, go to foreign countries and increase your knowledge of world affairs, wireless offers you the chance of a lifetime. However, you are not obliged to travel but may secure a permanent position at one of the many land radio offices, railroads, telegraph or steamship companies, if preferred.

Pay As You Learn

Our plan of payment places a wireless education within the reach of anyone who desires to learn.

A small payment down on our convenient payment plan and small following payments enable you to earn the cost of your tuition while actually learning to be a wireless operator.

Free Instruments To Every Student

In addition to six text books—thirty-five special lessons and eighteen personal examinations—we send you, while taking our course, a Standard Automatic Transmitting and Receiving set for sending and receiving messages. These fine instruments are free only to National Radio Institute students.

Membership in N. R. I. Relay League

Upon enrollment every student in the National Radio Institute is presented with a handsome blue and gold pin signifying his official membership in the N. R. I. Relay League, with a rapidly growing membership throughout the world.

Supplemental Course In Radio Telephony

In addition to our complete course in radio telegraphy, every student is given our complete course in modern radio telephony. This course comprises ten special lessons and ten personal examinations. These combined courses enable our students to fill positions requiring thorough knowledge of both radio telegraphy and modern radio telephony.

Send the following coupon to day for our FREE book containing all particulars and special offer to students enrolling now.

MAIL THIS COUPON TODAY

National Radio Institute,
Dept. 178, 14th and U Sts., N. W.
Washington, D. C.

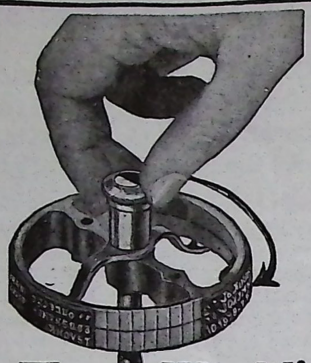
Send me, free of charge your booklet, "Wireless The Opportunity of Today," with full particulars regarding your famous Home Study Course in Wireless Telegraphy and Telephony and your Special FREE INSTRUMENT OFFER.

Name.....

Address.....

City..... .....State.....

No Other Typewriter Can Do This:
MULTIPLEX HAMMOND'S
Instantly changeable type
Many styles, many languages
Two types or languages always in the machine
Just Turn the Knob to change



The World's Most Wonderful "Writing Machine"

Here's a polyglot machine that writes all languages from Eskimo Indian to Kata Kana Japanese and over 365 different type-sets. The type is instantly interchangeable — two different languages or type sets are always on the machine. You "Just turn the knob"—to change language or type.

Hammond MULTIPLEX

"Many Typewriters In One"

Sounds like an Arabian Nights story but the machine itself is very practical, very real. It is the typewriter President Wilson uses personally—the typewriter he took with him when he visited King George.

Types for all purposes
and for all languages
Spacing to suit size of type
Perfect alignment
Automatic Type Impression
All on one MULTIPLEX

The marvelous INSTANTLY *interchangeable type feature* is only one of the many reasons why thousands of prominent men and women in all walks of life prefer *and personally* use the Multiplex.

Write today for FREE BOOKLET

It will show you how, with the Multiplex you can put the **force of emphasis** into your typed matter—how you can drive home with strength of accent the fullness of your argument—how you can write with the same convincing force that you use in speaking—an **exclusive feature** of the Multiplex.

Write your name, address and occupation on the margin of this page **NOW** and mail to

HAMMOND TYPEWRITER CO.
639 East 69th St. New York City

Also an Aluminum PORTABLE Model. 11 lbs. Full capacity. Ask for special Folder.

Build Your Own PHONOGRAPH

It's Easy With Our Help

Get Our FREE Blue Print OFFER

Interesting work—saves many dollars—gives you a fine machine exactly to suit your ideals—saves over half. Plays any record. Our customers always succeed because our system is simple. No special skill necessary. We furnish complete, plain plans and diagrams—motors, tone arms, case material, everything required and full instructions. Charles F. Mancke, Washington, says:—Received the outfits and am well pleased. Built one machine for myself and took an order for one for $175. I have mine done. It has a wonderful tone.

Make Money Building Phonographs

Ask for our Sure-Fire Plan and Free Blue Print Offer. We have started many others. We can start you. Pleasant, easy work. N. J. Adams, Michigan, says:—"Just sold my phonograph, which I built from your plans and parts at nearly $100 profit."

We are the old reliable house originators of the home building idea. Get our proposition. Write today.

SAVE OVER HALF

Choraleon Phonograph Co.
306 Choraleon Bldg., Elkhart, Ind.

Know the Electron—You Meet It Every Day in Radio

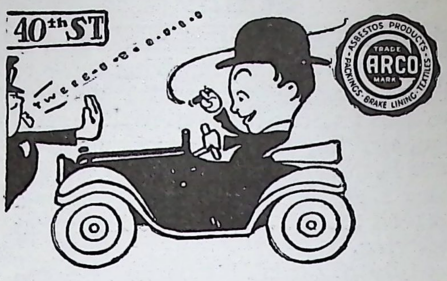
THE following are some notes on the electron taken from a chapter on that subject in a newly published book, "Realities of Modern Science" (MacMillan & Co.), by John Mills, a scientist who has written much on this and related highly technical subjects. Radio students will do well to read the entire book, as it correlates and makes understandable many laws and theories too often thought unrelated. Especially is the part on the electron worthy of attention. Electron theory is entering into an increased number of phases of radio in these times.—EDITOR.

IN finding how the matter of the universe is composed, scientists have at last reached the electron. In terms of it they can explain fairly well everything else, or at least there is promise that ultimately everything else will be so explained.

That the electrons are really mere specks in this universe of ether we realize readily from the statement that the radius of an electron is probably not larger than 2x10-13 cm. and that of a hydrogen atom is about 2x10-8 cm. The whole atom is perhaps one hundred thousand times as large in diameter as the electron. In other words, the radius of the electron is about as large, compared to the radius of the atom, as is the radius of our earth as compared to the orbit in which it travels around the sun.

In the case of atoms there are two ways in which electrons may be obtained. In the first case we may jar electrons loose from the atom. In the second case the electron may be thrown off by some disturbance having its origin in the atom itself. In this second case we call the substance "radioactive." Of such substances radium, discovered in 1897 by Monsieur and Madame Curie, is the best example. Other radioactive substances are uranium, thorium, actinium, and polonium. The atoms of such substances appear to be disrupting; not that all of them do so at once, but that of a bit of such a substance some of the atoms are always breaking down in this way. In such a breakdown electrons are shot out or other changes take place, and the result is new elements. Radium is believed to be a product due to the disintegration of uranium, and this may later be found true of the other radioactive elements.

Uranium, which is the heaviest known atom, has at least ninety-two electrons; that is, it has ninety-two electrons exclusive of any that may be contained in the nucleus, the construction of which we are about to consider. Between hydrogen, with only one electron, and the unstable uranium, with its ninety-two, lie all the possible elements. If one considers that an atom must have a whole number of electrons, it will appear that the other eighty-four known elements may fit in between hydrogen and uranium and still leave six yet to be discovered.



40 Stops from 1st Street to 40th

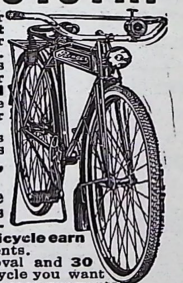
Not a happy life for ordinary brake lining. But Garco doesn't mind it. Not a bit. For Garco's not ordinary. It's good for steen thousand stops of that kind—and for just as many of those "slow downs" from 40 miles to nothing in half as many seconds.

Specially selected asbestos; fine, strong wire; a friction that goes clear through. That's Garco. Your dealer will tell you more.

General Asbestos & Rubber Co.
Charleston, S. C.
NEW YORK CHICAGO PITTSBURGH

GARCO ASBESTOS BRAKE LINING

NINE MONTHS TO PAY



Immediate possession on our liberal **Easy Monthly Payment** plan—the most liberal terms ever offered on a high grade bicycle.

FACTORY TO RIDER prices save you money. We make our bicycles in our own **new model factory** and sell direct to you. We put real quality in them and our bicycles **must** satisfy you.

44 STYLES, colors, and sizes to choose from in our famous **RANGER** line. Send for big, beautiful catalog.

Many parents advance the first payment and energetic boys by odd jobs—paper routes, delivery for stores, etc., **make the bicycle earn money** to meet the small Payments.

DELIVERED FREE on Approval and **30 DAYS TRIAL.** Select the bicycle you want and terms that suit you--cash or easy payments.

TIRES wheels and parts for all bicycles—at half usual prices. **SEND NO MONEY** but write today for the big new catalog, prices and terms.

MEAD CYCLE COMPANY
Dept B109 Chicago

ROUGH ON RATS

A United States Department of Agriculture bulletin says: "The best bait usually is food of a kind that the rats and mice do not get in the vicinity. The bait should be kept fresh and attractive and the kind changed when necessary."

"Rough On Rats" mixes with any food. It rids premises of pests—quickly, thoroughly, cheaply. Get it at drug and general stores. "Ending Rats and Mice", our booklet, sent free; WRITE.

E. S. WELLS, Chemist Jersey City, N. J.

LIGHT YOUR HOME LIKE DAY—COST 1c

for 5 hours. Pure white 60 candle power light from common Kerosene.

SOLAR MANTLE LAMP

approved by government experts. Beats gas, gasoline or electricity. Entirely new. Every home interested. **AGENTS MAKE MONEY.** Weeks free trial. Write quick selling plan, territory and trial offer.

SOLAR LAMP CO., 47 Solar Bldg., Kansas City, Mo.

The terms "Negative and Positive Electricity" were introduced by Benjamin Franklin about 1756, long before the electron was known, for our knowledge of the latter has all developed since Roentgen's discovery in 1895 of X-rays. The reader probably knows about X-rays as a means of taking pictures of bone or teeth for surgical diagnosis. In Franklin's time it was known that if a glass rod is rubbed with silk it is electrified; that is, it acquires the ability to attract light particles, as bits of paper or pith balls. Two pith balls electrified by contact with the rod are found to repel each other. On the other hand, a rod of sealing-wax that has been electrified by rubbing it with cat's fur will produce effects similar to those of the glass rod. But there is an important difference. A pith ball charged by the glass rod and one charged by the sealing-wax will attract each other. These phenomena may be summarized in a simple law, namely, like electricities repel and unlike attract. To the electricity of the glass rod Franklin gave the name "positive" and to that of the sealing-wax, the name "negative." However charges of electricity are produced today, we still use these names.

Returning to our consideration of the atom, we may now summarize as follows: (1) the normal state of an atom is uncharged; (2) the atom consists of a number of electrons, and a nucleus which has a positive charge just equal to the negative electricity of the electrons; (3) the operation of charging a body with electricity consists in causing either an excess or a deficiency in the number of electrons in the body.

Commonly Accepted Evidence

The nucleus attracts the electrons, and they are in general very firmly held in the atomic radius. But why doesn't the attraction that exists between the positive nucleus and the negative electrons draw them together? To this question the scientist has as yet been unable to obtain an entirely satisfactory answer. For this and other questions we must await either further theories or more experimental evidence. The statements, however, that we have so far made as to the nature of the atom are supported by experimental evidence and are commonly accepted.

The nucleus we recognize as positive electricity; but we mean thereby merely that it has an excess of positive electricity over any negative which it may also include. In fact, there is evidence that the nucleus itself contains some electrons. In the case of radioactive substances we find that electrons are shot off, and also atoms that we recognize to be helium. Helium is a light monatomic gas, twice as heavy as diatomic hydrogen. Its atom consists of a nucleus and two electrons.

Learn Wireless at Home

The Demand for Wireless Operators Far Exceeds the Supply

The New York Wireless Institute will make you an operator—AT HOME—in your spare time—quickly, easily and thoroughly. No previous training or experience required. Our Home Study Course has been prepared by Radio Experts. Experts able to impart their practical and technical knowledge to *YOU* in an *easy* to *understand way*. The graded lessons mailed you will prove so fascinating that you will be eager for the next one. The instruments furnished *free*, will make it as easy to learn the Code as it was to learn to talk. *All you will have to do*, is to listen.

Big Salaries

Wireless operators receive excellent salaries ranging from $125 to $200 a month and it is only a stepping stone to better positions. There is practically no limit to your earning power. Men who but yesterday were Wireless Operators are now holding positions as Radio Engineers, Radio Inspectors, Radio Salesmen at salaries up to $5000 a year.

Travel the World Over

A Wireless Operator can visit all parts of the world and receive fine pay and maintenance at the same time. Do you prefer a steady position without travel? There are many opportunities at the numerous land stations or with the Commercial Wireless or with the Steamship Companies.

FREE Instruments and Text Books

This wonderful Set for learning the Code furnished free with our Course

We furnish free to all students, during the course, *the wonderful receiving and sending set exactly as produced in the illustration.* **This set is not loaned, but *given* to all students completing the Course.**

Easy Payments

A small payment down will enroll you. We will make the payments so easy that anyone ambitious to enter the fastest growing profession—Wireless—may do so.

The Transmitter shown is the celebrated *Omnigraph* used by several Departments of the U. S. Government and by the leading Universities, Colleges, Technical and Telegraph Schools throughout the U. S. and Canada. Start the *Omnigraph*, place the phone to your ear and this remarkable invention will send you Wireless Messages, the same as though you were receiving them, through the air, from a Wireless Station hundreds of miles away. When you apply for your license, the U. S. Government will test you with the *Omnigraph*—the same model *Omnigraph* as we furnish to our students. Ask any U.S. Radio Inspector to verify this.

FREE Post-Graduate Course

A one month's Post-Graduate Course, if you so desire, at one of the largest Wireless Schools in N. Y. City. New York—the Wonder City—the largest port in the World and the headquarters of every leading Wireless and Steamship Company.

Send for FREE Booklet

Without obligating you in any way, send for our booklet "How to Become an Expert Wireless Operator"—It is free. Mail the coupon below, or postal or letter—*but do it today.*

NEW YORK WIRELESS INSTITUTE
Dept. 53, 258 Broadway New York City

NEW YORK WIRELESS INSTITUTE
Dept. 53, 258 Broadway, N.Y. City

Send me free of charge, your booklet, "How to Become an Expert Wireless Operator," containing full particulars of your Course, including your *Free Instrument Offer*.

Name.....

Address.....

City or Town.....State.....

Free Book
Containing complete story of the origin and history of that wonderful instrument—the

SAXOPHONE

Easy to Play Easy to Pay

This book tells you when to use Saxophone—singly, in quartettes, in sextettes, or in regular band; how to transpose cello parts in orchestra and many other things you would like to know.
You can learn to play the scale in one hour's practice, and soon be playing popular airs. You can double your income, your pleasure, and your popularity. Easy to pay by our easy payment plan.

MAKES AN IDEAL PRESENT

Send for free Saxophone book and catalog of everything in True-Tone band and orchestra instruments

BUESCHER BAND INSTRUMENT CO.
285 Jackson Street, Elkhart, Ind.

BUELL
EXPLOSION WHISTLE
RELIABILITY

The autoist can count on the Buell in any emergency. Its dominant note compels instant action. Adopted as equipment by over 75 manufacturers. Easy to install, simple to operate, no maintenance cost. Guaranteed for 10 years.

In Single Tone or Chime. Ask your dealer or write us direct.

BUELL MFG. CO., Cottage Grove at 30th, CHICAGO

Be a Taxidermy Artist

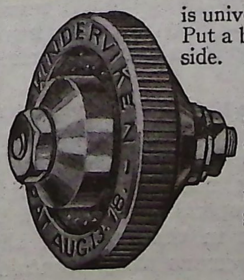
Marvelous Book Sent FREE

You can *now* learn Taxidermy, the wonderful art of mounting *birds, animals, tanning skins, etc.* Learn at home, by mail. The free book tells how. Mount your own trophies. Decorate home and den. Hunters, trappers, nature lovers, you need taxidermy. Interesting, fascinating, *big profits.* Join our school. 65,000 students. Success guaranteed. Send for our **free book** without delay.

N. W. SCHOOL OF TAXIDERMY
1203 Elwood Bldg. Omaha, Neb.

CLASS PINS & RINGS
DIRECT FROM FACTORY TO YOU
OUR NEW CATALOG WITH 600 OF THE LATEST UP-TO-DATE DESIGNS FREE.
C. K. GROUSE CO.
12 Bruce Ave. North Attleboro, Mass.

Skinderviken Transmitter Button



is universal for making up Deaf-phones, Detecti-phones, Amplifiers, etc. Put a button on the outside of a window and listen to all that is said inside. Attach it to your Phonograph and transmit music, etc., to distant points. The best Transmitter for Local and Long Distance Telephone Saves 75% Batteries. Super-sensitive. **Send me $1.00 for one Button with free descriptive booklet and circuit diagrams.**

All kind of experimenters' supplies in stock. Receivers, induction coils, condensers, etc. Price list on request. Satisfaction guaranteed or money back.

J. SKINDERVIKEN
Inventor and Sole Distributor
335 Broadway, New York City, or 154 West Randolph Street, Chicago, Ill.

Be An Expert Accountant

—The Man Who Directs

Everywhere in business there is need for the man who knows Higher Accounting. To meet the competitive conditions that exist today, waste must be eliminated, accurate cost systems must be installed, economies must be put into effect and the management must have the whole situation charted and shown in figures whenever wanted.

Over 500,000 American concerns today need the services of men who can do this. That shows where opportunity is. Write today for information about the course in Higher Accounting given by LaSalle Extension University.

Learn Higher Accounting By Mail

The LaSalle method will train you by mail under the direct supervision of William B. Castenholz, A. M., C. P. A., former Comptroller and Instructor, University of Illinois, assisted by a staff of Certified Public Accountants including members of the American Institute of Accountants. Analysis and Organization, and the Principles of Accounting, Auditing, Commercial Law and Scientific Management all made clear; and you will be given special preparation for the C. P. A. examinations. You can now learn at home in your spare time while you hold your present position. Pay for the course a little each month if you wish.

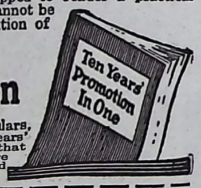
LaSalle Students and Graduates

of our various specialized departments can now be found employed by practically all the large railroad and commercial organizations in the United States. For instance—*Pennsylvania R. R. 2102, American Telegraph & Telephone Co. 811, U. S. Steel Corporations 309, Baltimore & Ohio R. R. 946, Chicago & N. W. Ry. 712, Swift & Co. 308, Standard Oil Co. 390, Armour & Co. 364.*

Over 35,000 new students now enroll annually. The LaSalle organization consists of 950 people, including a staff of 450 business experts, professional men, text writers, special lecture writers, instructors and assistants.

Free Consulting Service

As a LaSalle student, you will also be entitled to the free use of our Consulting Service which gives you the privilege of calling on our staff of experts in any department at any time when you need special help or counsel. LaSalle Extension University is a clearing house of business information and through its many highly specialized departments is organized and equipped to render a practical and distinct service which cannot be supplied by any other institution of similar character.



Send Coupon

We will send full particulars, also a free copy of "Ten Years' Promotion in One," a book that has been an inspiration to more than 185,000 ambitious men. Send for your copy now.

LASALLE EXTENSION UNIVERSITY
"The Largest Business Training Institution in the World"
Dept. 383-H Chicago, Illinois

Without cost or obligation on my part, please send me particulars regarding your Home Study Course of Training in Higher Accounting and your valuable book for ambitious men, "Ten Years' Promotion in One."

Name.....

Present Position.....

Address.....

Electrical Engineering men with training are in demand. For more than a quarter of a century, this school has been training men of ambition and limited time, for the electrical industries. Condensed course in Electrical enables graduates to secure good positions and promotions. Theoretical and Practical Electricity. Mathematics, Steam and Gas Engines and Mechanical Drawing. Students construct dynamos, install wiring and test electrical machinery. Course with diploma complete

In One Year

Over 3000 men trained. Thoroughly equipped fireproof dormitories, dining hall, laboratories, shops.
Free catalog. 28th year opens Sept. 29, 1920.
BLISS ELECTRICAL SCHOOL 102 Takoma Ave., Washington, D. C.

Free Book-LAW

Send for this Free 118 Page Book. It tells how you can gain a thorough knowledge of law in your spare time, as 40,000 others are doing. Splendid opportunities in the profession of law. Business today needs law trained men. Free book gives experiences of successful law trained men, and tells how you can read law under guidance of Ex-President Taft and 80 other eminent authorities.

Blackstone Institute
Dept. 123, 608 S. Dearborn Street, Chicago

The question of how the electrons of an atom group themselves under the action of their mutually repellent forces and the attraction of the nucleus is a difficult problem of mathematical physics. An interesting study has been made, however, of the manner in which a number of similar particles, which repel each other, would group themselves in a plane, under the action of a centrally located source of attraction.

In this experiment a number of small magnetic needles were first mounted vertically through small cork and thus floated on the surface of a vessel of water. Similar poles of the needles projected upward through the corks. A long magnet was suspended vertically above the vessel, so that a pole of opposite character to those of the needles might act as a center of attraction.

It was discovered that the configurations into which the floating poles grouped themselves depended upon their number. Thus three poles placed themselves at the corners of an equilateral triangle, the center of which was just below the attracting magnet. Similarly four magnets group at the corners of a square and five at the vertices of a regular pentagon.

When six magnets enter into the configuration, one goes to the center, immediately below the pole of the large magnet, the other five forming a pentagon. With seven and eight, similar figures are formed with one magnet at the center. With nine there are two in the center and seven in the outside ring. With ten or eleven there is an inner triangle and an outer ring of either seven or eight.

The number in the center increases until, when the total is fourteen, there is a pentagon inside and a ring of nine outside. In other words, as the number entering into the configuration is increased, certain arrangements recur. When the number is increased to fifteen, there is an outer ring of nine, an inside ring of five, and in the center of this a single magnet. As the number of magnets increases certain configurations appear more or less periodically, that is to say, at definite intervals.

It is reasonable, therefore, to expect, as prominent scientists have done, that, whatever the positive nucleus of the atom may be, atoms differing in their compositions by definite numbers of electrons may, in part, have similar configurations for their electrons.

In so far as the electron configuration, as well as the number, determines the characteristics, such atoms should have certain similarities in chemical properties. If a list is made of atoms in the order of the number of electrons they contain, those of similar properties might be expected to occur periodically in the list.

Win a $500 Scholarship

To encourage schools to make practical application of their class work and to popularize science, Popular Science Monthly will at the end of this school year, award 10 scholarships of $500 each to high school students.

Entrance Date Extended to April 1, 1920

Because so many ambitious students who wish to enter this contest did not get their names in on February 1, Popular Science Monthly has decided to extend the date for entries for these scholarships to April 1,1920.

Conditions

The following are the conditions for winning one of these scholarships:

1.—These Scholarships are open to Seniors in all High Schools and Private Schools in the United States.

2.—Names of Candidates, giving their school and their home address, must be mailed to Scholarship Committee, Popular Science Monthly, 225 West 39th Street, New York City, by the principal or headmaster of the school on or before April 1, 1920.

3.—The Scholarships will be awarded to the candidates passing the best examination on the important new scientific inventions and discoveries which have been outlined in the Popular Science Monthly. The examination will be given in the candidate's own school during the last week in May, 1920.

4.—The questions will be based on the topics in the Teachers' Service Sheets of Popular Science Monthly for the months of December, 1919, to and including June, 1920. These Service Sheets are furnished free to Science teachers.

5.—The examination papers will be sent to the Principal of every school where there are pupils to compete. The papers will be sent in a sealed envelope which must be opened in the presence of the candidates.

6.—The $5000 will be divided into ten Scholarships of $500 each. One Scholarship of $500 will be awarded to one student in each of the following groups of States:

New England Group: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.
New York Group: New York City and State.
New Jersey and Pennsylvania Group: New Jersey and Pennsylvania.
Mid-Atlantic Group: Delaware, Maryland, Virginia, West Virginia, Kentucky, Tennessee.
South Atlantic Group: North Carolina, South Carolina, Georgia, Alabama, Florida, Porto Rico.
Great Lakes Group: Ohio, Indiana, Michigan.
Central Group: Illinois, Wisconsin, Minnesota.
Prairie Group: Iowa, Missouri, Kansas, Nebraska, South Dakota, North Dakota.
South Central Group: Arkansas, Mississippi, Louisiana, Oklahoma, Texas.
Western Group: Wyoming, Montana, Colorado, New Mexico, Idaho, Utah, Arizona, Washington, Oregon, Nevada, California, Hawaiian Islands.

7.—The Popular Science Monthly reserves the right to publish the answers together with the names and photographs of the winners of these Scholarships.

8.—Winners may select any College or University they wish to attend.

Ask your principal to send in your name to-day

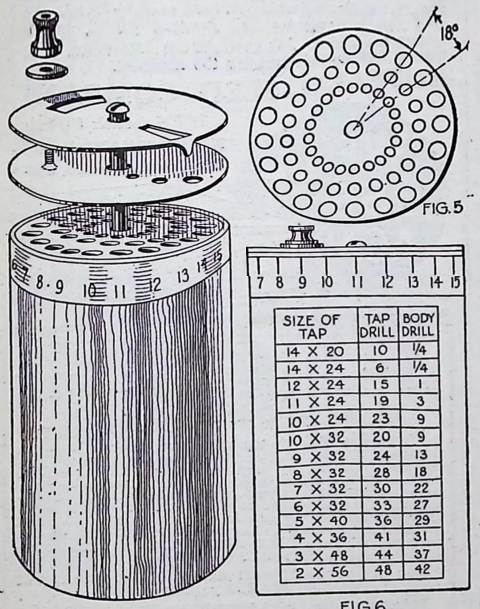
SCHOLARSHIP COMMITTEE

Popular Science Monthly
225 West 39th Street New York

How to Locate Instantly a Particular Drill

AMONG the labor-saving tools in my collection is a unique drill-case which at any moment locates the desired drill, yet when closed will not allow the drills to spill.

I first obtained a steel collar about half an inch wide and having an inside diameter of approximately 3 in. This was cut from a steel tube having a thickness of about 1/16 in. The collar was rough, and by means of a buffing wheel was soon brought to a polished surface. Measuring the outside circumference accurately and dividing the result by 20, I used a set of protractors, scratched the divisions, and stenciled the figures, using a steel punch and a piece of round iron about 2½ in. in diameter clamped



SIZE OF TAP	TAP DRILL	BODY DRILL
14 X 20	10	1/4
14 X 24	6	1/4
12 X 24	15	1
11 X 24	19	3
10 X 24	23	9
10 X 32	20	9
9 X 32	24	13
8 X 32	28	18
7 X 32	30	22
6 X 32	33	27
5 X 40	36	29
4 X 36	41	31
3 X 48	44	37
2 X 56	48	42

FIG.6

With this contrivance you can easily locate and take out the special drill needed for the particular work on hand

in a vise. The divisions were numbered from 1 to 20 inclusive. (See Fig. 1.)

Next I secured a piece of hardwood 3½ in. square by 5 in. long, and, centering it in the lathe, turned down one end for ½ in., so that the collar had to be forced or driven on. Then I turned the rest of the block down to the same outside diameter as the collar.

With the collar end down, I drilled a ½-in. hole about ½ in. deep in the center of the bottom of the block. Reversing the block, I drilled a hole with a No. 9 drill all the way through, the hole coming out in the center of the ½-in. hole previously drilled. (See Fig. 2.)

Out of 1/16-in. brass I cut two disks (as shown in Figs. 3 and 5). The cut shows the size of holes to drill and gives the dimensions. The three holes of different sizes on the disk in Fig. 3 should be counter-sunk on the top, and the one hole opposite, after being tapped, counter-sunk on the bottom,

SHUMATE RAZOR

SMOOTH!

"YES! AND IT'S GUARANTEED TO KEEP MY FACE SMOOTH FOR LIFE"

SHUMATE RAZORS are so good that we guarantee them for life. Here's the reason: The blade is made from tungsten alloy steel, which takes a keener edge than any other steel can -- and holds it. You can use a SHUMATE for years without honing. The secret of this wonderful steel is ours alone, and we guard it jealously.

Written Guarantee with Each Razor

Buy a SHUMATE RAZOR and use it, not only a few times, but as long as you like. If you decide after an exacting trial, that you don't like it, we'll exchange it for a new one without a word.

Ever recline in a barber's chair and almost go to sleep as you experienced that delightful, soothing sensation when his razor swept your face clean? And have you said to yourself "I wish I had a razor that would perform like that"? A SHUMATE will do it and -- keep on doing it.

$2. Send us $2.00 and the SHUMATE Barber razor will be sent to you postpaid. If your beard is extra wiry, we recommend our $3.00 SHUMATE RAZOR, specially ground for this purpose. In remitting, give us your dealer's name, and a chamois lined, rust-proof case will be included with your razor.

SHUMATE RAZOR COMPANY, 808 CHESTNUT ST. ST. LOUIS, U. S. A.
Established 1884 Capacity 10,000 Razors Daily

An Indoor Toilet
For Every Home — Comfortable — Convenient — Sanitary
COMFORT CHEMICAL CLOSET

Provides practical, sensible and sanitary accommodations indoors protected from cold, stormy weather.

Makes Homes Modern

Easily installed---Easily cleaned---Plumbing unnecessary. Made of high grade materials, heavily enameled---white or gray.

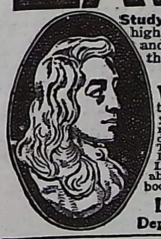
Absolutely Odorless

Scientifically ventilated. Chemicals dissolve contents---kill germs. Approved by U. S. Health Bureau and Boards of Health.

30 DAYS FREE TRIAL.

Sales Agents Wanted--Splendid opportunity. Exclusive territory. Write today. Booklet Free.
Comfort Chemical Closet Co., 1323 Factories Bldg., Toledo, O.

BECOME A LAWYER



Study At Home. Legally trained men win high positions and big success in business and public life. Greater opportunities now than ever. Be a leader. Lawyers earn $3,000 to $10,000 Annually

We guide you step by step. You can train at home during spare time. We prepare you for bar examination in any state. Money refunded according to our Guarantee Bond if dissatisfied. Degree of LL. B. conferred. Thousands of successful students enrolled. Low cost, easy terms. Fourteen-volume Law Library free if you enroll now. Get our valuable 120-page "Law Guide" and "Evidence" books free. Send for them—NOW.

LaSALLE EXTENSION UNIVERSITY
Dept. 383-L Chicago, Ill.

New Tax Laws Open $10,000 Jobs

Corporations and individuals overtaxed themselves millions of dollars last year because of ignorance of the new laws. Our students discovered a $4,000,000 over-payment by one corporation. As a result a tremendous opportunity is offered to men who will spend a few hours in study. Salaries of $5,000 a year are ordinary. Consulting specialists have earned as high as $1,000 a week. You can qualify—in your own home during spare time.

Write Today for Free Book No obligations. The book is free. Opportunity is calling.
U. S. Tax Law Institute 122 S. Michigan Avenue Dept. 1203, CHICAGO

AUTOMOBILE BOOKS

FREE illustrated catalog on Helpful, Instructive Automobile Books—Repairing—Welding—Starting and Lighting--Construction--Operation, Etc. Address Book Department D3
AUTOMOBILE DIGEST, Cincinnati, Ohio

"Old Town Canoes"

OLD TOWN CANOE CO.
1993 Main St.
Old Town, Maine, U.S.A.

Every Stroke Counts

Laze along in the alder shadows or shoot through swift water, an "Old Town Canoe" will obey every move of your paddle. Light as a bubble, graceful as a swan, but staunch as a scow. The "Sponson Model" is the safest canoe made—safer than most row boats. Write for catalog. 3000 canoes in stock. $67 up. At dealer's or factory.

Mechanical Engineering

Learn at Home!

Employers everywhere are looking for men with mechanical ability. Splendid salaries and rapid advancement are offered.

There is an easy, delightful way in which you can learn right at home in spare time. For 28 years the International Correspondence Schools have been giving men and women just the training they need for success in mechanical engineering and more than 200 other subjects. Hundreds of thousands have stepped into good positions through I. C. S. help, but never were opportunities so great as now.

Let the I. C. S. help *you*. Choose the work you like best in the coupon below, then mark and mail it today. This doesn't obligate you in the least and it will bring you information that will start you on a successful career. This is your chance. Don't let it slip by. Mark and mail this coupon *now*.

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
BOX 7668, SCRANTON, PA.

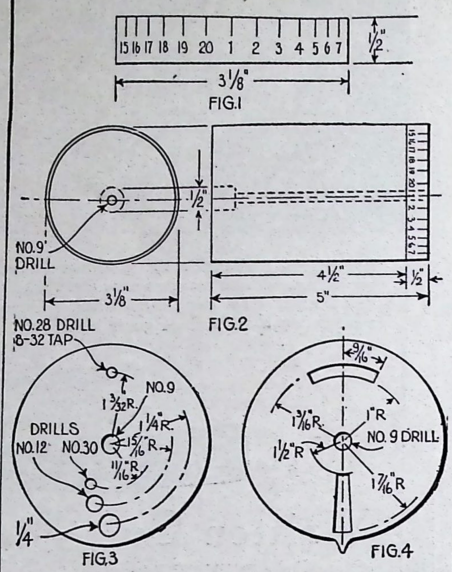
Explain, without obligating me, how I can qualify for the position, or in the subject, *before* which I mark X.

- ☐ ELECTRICAL ENGINEER
- ☐ Electric Lighting and Rys.
- ☐ Electric Wiring
- ☐ Telegraph Engineer
- ☐ Telephone Work
- ☐ MECHANICAL ENGINEER
- ☐ Mechanical Draftsman
- ☐ Machine Shop Practice
- ☐ Toolmaker
- ☐ Gas Engine Operating
- ☐ CIVIL ENGINEER
- ☐ Surveying and Mapping
- ☐ MINE FOREMAN or ENG'R
- ☐ STATIONARY ENGINEER
- ☐ Marine Engineer
- ☐ Ship Draftsman
- ☐ ARCHITECT
- ☐ Contractor and Builder
- ☐ Architectural Draftsman
- ☐ Concrete Builder
- ☐ Structural Engineer
- ☐ PLUMBING AND HEATING
- ☐ Sheet Metal Worker
- ☐ Textile Overseer or Supt.
- ☐ CHEMIST
- ☐ Mathematics
- ☐ SALESMANSHIP
- ☐ ADVERTISING
- ☐ Window Trimmer
- ☐ Show Card Writer
- ☐ Sign Painter
- ☐ Railroad Trainman
- ☐ ILLUSTRATING
- ☐ Cartooning
- ☐ BUSINESS MANAGEMENT
- ☐ Private Secretary
- ☐ BOOKKEEPER
- ☐ Stenographer and Typist
- ☐ Cert. Pub. Accountant
- ☐ TRAFFIC MANAGER
- ☐ Railway Accountant
- ☐ Commercial Law
- ☐ GOOD ENGLISH
- ☐ Teacher
- ☐ Common School Subjects
- ☐ CIVIL SERVICE
- ☐ Railway Mail Clerk
- ☐ AUTOMOBILE OPERATING
- ☐ Auto Repairing
- ☐ Navigation
- ☐ AGRICULTURE
- ☐ Poultry Raising
- ☐ Spanish
- ☐ French
- ☐ Italian

Name
Present Occupation
Street and No.
City State

Canadians may send this coupon to International Correspondence Schools, Montreal, Canada 7-25-10

Into this latter hole I screwed the threaded end of an 8/32-by-¼-in. machine screw, and, turning the disk over, headed the end into the countersunk portion. Then I cut the head of the machine screw off, leaving a threaded stud about ⅜ in. long pro-



Showing how the drill-case is constructed, and just how it permits you to determine where a certain drill is located

jecting upright from the disk. To cut the two slots shown in Fig. 4, I drilled a number of holes and filed them out.

I then made a paper disk as shown (page 137), the dimensions from the center and the size of drills being the same as the bottom three holes in Fig. 3, and glued to the collar end of the block, being careful that the outside circle of large holes exactly coincided with the numbered divisions on the collar.

Placing it on a drill-press so as to obtain perfectly straight holes, I drilled the holes as shown in Fig. 5, being careful that the drill always went straight in the center of each hole and was not influenced by the grain in the wood.

If, however, the wood is of such grain that the drills will not run straight, paste the paper template on a small piece of brass plate and drill the holes, afterward using the brass template to guide the drills in the wooden block.

I placed a 10-by-5-in. round-headed machine screw through the center hole in the disk of Fig. 4, through the disk of Fig. 3, and down through the collar end of the block. A plain washer, a lock washer, and a nut are applied, and the end of the machine screw slightly headed over, so that the nut will not come off.

On the threaded stud of Fig. 3 now projecting through the disk of Fig. 4, I placed an 8/32-in. copper washer and a little knurled thumb-nut taken from the terminal of a dry-cell battery. The sliding of the top disk on the other disk allowed the three different size

First Prize

Won By SCOUT KENNEDY PEIRCE, Tr. 63, Kansas City, Mo.

The judges decided that Scout Peirce's contest letter contained the sixteen best uses for the Auto-Wheel Coaster.

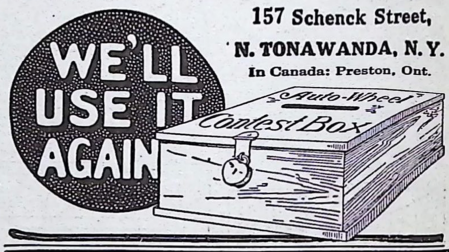
His Prize is the Auto-Wheel Coaster Itself.

The Other Prizes Were Awarded as Follows:

2nd. Tent, Henry Jacobs, 37 Watkins St., Brooklyn, N. Y.
3rd. Poncho, Frederick M. Easley, S. C.
4th. Fleetwing Racer, Jas. O. Pierce, - - West Plains, Mo.
5th. Camera, E. B. Roensch, Dooley Bldg., Houston, Tex.
6th. Mess Kit, W. Hayward, 603 Cross St., Ypsilanti, Mich.
7th. Flashlight, Jas. A. Bishop, Route 12, Knoxville, Tenn.
8th. Knife, Arthur Rick, 223 Mariposa St., Syracuse, N. Y.
9th. Scout Axe, Joseph Gerend, Box 76, S. Kaukauna, Wis.
10th. Watch, Albert Schulte, - - Box 364, Houghton, Mich.
11th. 3-Coin Bank, Stuart Demarest, - Roselle Park, N. J.
12th. Scout Compass, Charles E. Brady, - - Glen Ellyn, Ill.

There will be several more Auto-Wheel contests this year. Watch for the announcements. Get the Auto-Wheel Booklet now. Send us the names of three local coaster dealers, mentioning which one handles Auto-Wheel. We'll send you a handsome *Felt Pennant FREE*, and our attractive booklet. Ask us about the Auto-Wheel Clubs—how to get special Caps for the members.

BUFFALO SLED COMPANY,
157 Schenck Street,
N. TONAWANDA, N. Y.
In Canada: Preston, Ont.



A-10 Wireless MESCO Manual A-10

About March 15th we will have ready for distribution a new Manual and Catalog of standard radio material illustrating and describing in detail the various instruments used in connection with the transmission and reception of wireless messages. No expense has been spared to make this Wireless Manual complete and up-to-date in every way so as to be of assistance not only to the amateur, but also to the professional user and experimenter in the most fascinating of all modern arts.

The size of the Manual will be 4¾" x 9" and will contain approximately 180 pages.

If interested send in your name and address and a copy will be sent to you as soon as issued.

Manhattan Electrical Supply Company, Inc.
New York, 17 Park Place — St. Louis, 1106 Pine St.
Chicago, 114 So. Wells St. — San Francisco, 604 Mission St.

Don't Wear a Truss

MR. C. E. BROOKS

Brooks' Appliance, the modern scientific invention, the wonderful new discovery that relieves rupture, will be sent on trial. No obnoxious springs or pads.

Brooks' Rupture Appliance

Has automatic Air Cushions. Binds and draws the broken parts together as you would a broken limb. No salves. No lies. Durable, cheap. Sent on trial to prove it. Protected by U. S. patents. Catalog and measure blanks mailed free. Send name and address today.

BROOKS APPLIANCE CO., 255B State St., Marshall, Mich.

You Can Save $50.00

By recovering your old auto top frame yourself. We make these recovers to fit all makes and models of cars. Any person that can drive a car can put it on. We furnish instructions. Roof and quarters sewed together with rear curtain, fasteners, welts and tacks. All complete. Give us the name, year and model number of your car and we will send you our catalogue with samples and quote you exact price.

$6.84 and up Parcels Post Paid

LIBERTY TOP & TIRE CO., Dept. E8, Cincinnati, O.

STUDENTS ART MAGAZINE Publishes cash art assignments, lessons and articles on Cartooning, Designing, Illustrating, Lettering and Chalk-Talking. Criticises amateurs' work. Full of information for artists and art students. Satisfactory or money refunded. 20c a copy, $1 a year.

Send $1 NOW, Thrift Stamps Taken

G. H. LOCKWOOD, Editor, Dept. 584 Kalamazoo, Mich.

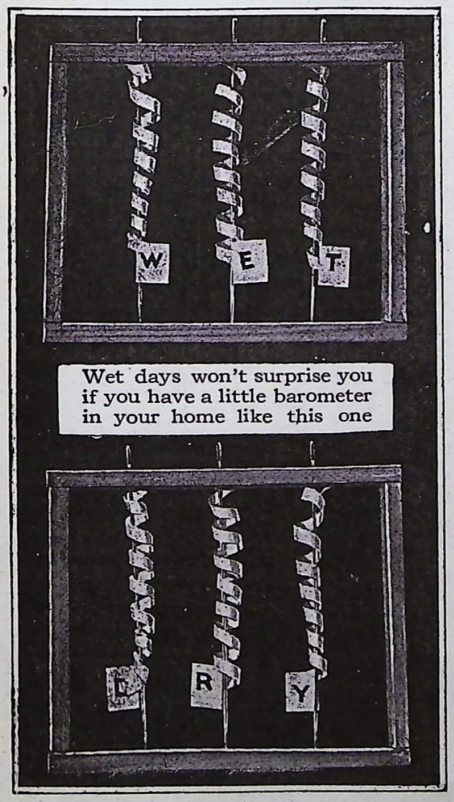
holes to appear in the slot of the top disk. Thus, if I want any drill from 1 to 20 inclusive, I set the disk so that the large hole appears and turn the pointer located on the top disk to the desired number on the collar. To obtain any drill between 21 and 40 inclusive—as for example No. 36—I subtract 20 from the number, and with the middle hole set in the slot turn the pointer to No. 16. The process for obtaining drills from 41 to 60 is identical, with the exception of using the smallest hole and subtracting 40.

The disks may be set so that none of the holes will appear and thus will be locked.

The assembled instrument is shown in Fig. 6. and the table of drills for a given tap may be stenciled on the wooden surface of the block.

It Rivals the Weather Bureau in Accuracy

THIS little instrument is composed of a small wooden frame with three large darning-needles piercing the top bar and having their points embedded in the lower part of the



frame. Around these are twisted three spirals of metal foil, fastened at the top but free at the bottom.

At the extremity of each is fastened a small square of paper. On one side of these is the word "Wet" and on the other side "Dry."

On a dry day the instrument is set to read "Dry." When rain is in the air the humidity of the atmosphere twists the tinfoil and turns the squares of paper so that they read "Wet."—M. JOHNSON.

"I wonder if he's going to be ill"

REMEMBER—it is a fact that thousands upon thousands of men and women, weakened through the stress and strain of work and worry, have regained vitality and working power by using Sanatogen.

When Sir Gilbert Parker writes: "Sanatogen is a true food-tonic, feeding the nerves and giving fresh vigor to the over-worked body and mind," he but expresses the conviction of multitudes of others.

That thousands of physicians have endorsed Sanatogen in writing; that many physicians, including famous nerve specialists, use Sanatogen in their own families—these facts speak for themselves.

And thus you may be sure you can find no more trustworthy safeguard for your health at such times than Sanatogen.

Sanatogen is sold by good druggists everywhere, in three sizes, $1.20 up.

Awarded Grand Prize at the International Congress of Medicine; London, 1913

Write today for interesting free booklet to
THE BAUER CHEMICAL CO., Inc.
115 West 18th Street, New York City

THE FOOD-TONIC APPROVED BY SCIENCE

Sanatogen
Endorsed by Physicians the World Over

Complete Musical Outfits On Trial

YOU may have your choice of instruments and a complete musical outfit for a week's free trial in your own home. Outfit includes case, music rack, all accessories, instruction book, etc. at factory prices. A tremendous saving.

Convenient Monthly Payments

After trial return outfit at our expense if you wish. If you decide to buy you may pay the low direct price in small monthly amounts. Wurlitzer for 60 years has meant highest quality.

Send this Coupon

We'll send you free and without obligation the Wurlitzer 160-page illustrated catalog. Mail the coupon.
The Rudolph Wurlitzer Co. Dept. 1203
E. 4th St., Cincinnati—S. Wabash Ave., Chicago

The Rudolph Wurlitzer Co.
Dept. 1203
117 E. 4th St., Cincinnati, Ohio
329 S. Wabash Ave., Chicago, Ill.
Send free your 160-page catalog with full details of complete musical outfit on easy terms.

Name .....
Address .....
Instrument I am Specially Interested In .....

WURLITZER
Reg. U. S. Pat. Office

MULLINS STEEL BOATS CAN'T SINK

Steel compartments for and aft like in a life-boat make these boats absolutely safe. Puncture-proof steel hull can't leak, waterlog, dry out or open at the seams. Never needs calking, no boat-house required. Powered with best marine motor, having silent under-water exhaust.

Mullins boats are designed by America's leading naval architects and built in the world's largest boat factory. More than 70,000 in use.

Write for catalog of over 40 models of steel and wooden power boats, rowboats and canoes.

MULLINS BODY CORPORATION
BOAT DEPARTMENT
619 FRANKLIN STREET - - - - SALEM, OHIO

CUNARD ANCHOR

REGULAR SERVICES

NEW YORK--LIVERPOOL
NEW YORK -- CHERBOURG -- SOUTHAMPTON
N. Y.--PLYMOUTH--HAVRE--SOUTHAMPTON
N. Y.--PLYMOUTH--CHERBOURG--LIVERPOOL
NEW YORK -- PLYMOUTH--HAVRE--LONDON
NEW YORK--L'DERRY--GLASGOW
NEW YORK--MEDITERRANEAN

Schedules on application

21-24 State Street New York

or Branches and Agencies

Have Cozy Rooms For 17c a Day

Now made possible by this latest Larkin Factory-to-Family plan. One of three rooms furnished completely for only 17c a day. Take two years to pay.

800 Beautiful Furnishings Await Your Choosing

Welcome surprises await you in the large amount of furnishing you can do at small expense. High quality furnishings of tasty and beautiful design, on easy terms, at rock-bottom prices surely merit your investigation.

Big Helpful Book Now FREE

Every one of its 104 pages contains intensely interesting offers for the home lover. Write for your book now.

Larkin Co. Desk FPSM 320 Buffalo, N Y

Raise Belgian Hares

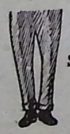
for us. Wonderful profits easily made at home. We furnish high grade stock and pay you $7 to $12.50 a pair and express charges for all you raise.

Illustrated catalog and contract Free

UNITED FOOD & FUR ASSOCIATION
329 West 48th St. Desk 4 New York

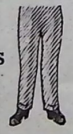
WANTED—A Representative in every factory in the United States. POPULAR SCIENCE MONTHLY, 225 West 39th Street, New York.

"BOW LEGS and KNOCK-KNEES" UNSIGHTLY



SEND FOR BOOKLET SHOWING PHOTOS OF MEN WITH AND WITHOUT

The Perfect Leg Forms



PERFECT SALES CO., 140 W. Mayfield Ave., Dept. 45, Chicago, Ill.

Keep Tabs on all the new inventions and discoveries by subscribing to POPULAR SCIENCE MONTHLY.

"THERE'S MONEY IN IT"

AT HOME LEARN TELEGRAPHY AT HOME
MORSE AND WIRELESS

TEACH YOURSELF in half usual time, at trifling cost, with the wonderful Automatic Transmitter THE OMNIGRAPH. Sends unlimited Morse or Continental messages, at any speed, just as an expert operator would. Adopted by U. S. Gov't. and leading Universities, Colleges and Telegraph Schools. 4 styles. Catalog free.

OMNIGRAPH MFG. CO., Dept. H., 39 Cortlandt St., New York.

Managing Difficult Electrical Installations

ELECTRICIANS sometimes encounter worrisome problems in suiting the whims of their customers. A wireman was called upon to wire up a room in which the lamps and wires were all in place but not connected, because no electrician had been able to satisfy the customer's desire to have two lamps on each of two circuits fed through single-pole switches from a three-wire service, with no more than two wires at any part of the room except at the entrance. The wireman finally evolved the scheme shown in Fig. 1.

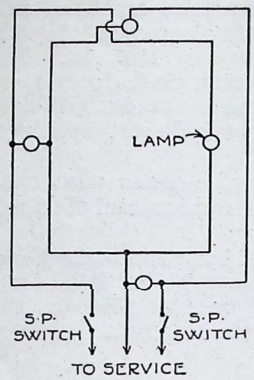


Fig. 1 shows how two lamps were wired on each of two circuits

Another man had four lamps in his stairway, located one at each of the four landings, which he wanted connected so that all of the lamps could be lighted or extinguished from any one of the switches located one at each of the four floors. How the electrician connected them is shown in Fig. 2. These are only two examples of the sort of thing electricians are up against every day. Therefore a man who follows this trade should have the faculty of resourcefulness.—FRANK GILLOOLY.

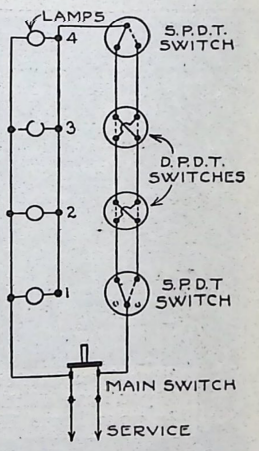


Fig. 2. How four lamps were extinguished from each of four floors

How to Use the Furnace for Cooking

MEALS are usually cooked in the kitchen range, and the furnace is used for heating; but by the following method it is possible to cook a great part of a dinner without any help from the kitchen fire, thus saving fuel and lightening the coal bill, or the gas bill, if your range is fed by gas.

A sheet-iron box, made to fit the opening of the furnace door, will utilize the space upon the hearth that would otherwise go to waste.

The back of this oven should project a few inches over the inner edge of the hearth, so as to receive the full benefit of the heat. As can be seen

Your Wireless Outfit

Have You Kept Pace With the Times?

Are you still operating the old style non-sensitive, poorly designed receiving apparatus? Or are you equipped with one of the new complete Gilbert Radio Outfits designed by an expert who was a Radio Officer in the U. S. Army during the war.

Gilbert Radio Outfits are complete in every respect for transmitting, receiving, or both. The Loose Coupler used in the receiving sets is not the old obsolete type that pulls out of the box, but the new enclosed panel type—a highly sensitive instrument designed particularly to minimize distribution capacity and to eliminate "dead end losses." It is a very compact instrument in a quartered oak cabinet, and is included in all Gilbert Radio Receiving Outfits. These outfits can be purchased complete or each part separately. Our new Radio catalog No. 50 describes each one in detail. Write for it today.

The A. C. Gilbert Company
310 Blatchley Ave. New Haven, Conn.
In Canada: The A. C. Gilbert-Menzies Co., Limited, Toronto

No. 4007
Receiving Set

Rider Agents Wanted

In every neighborhood to ride and exhibit a sample RANGER bicycle furnished by us. Choice of **44 styles**, colors and sizes in the famous **Ranger** line. Mead Rider Agents make big money in spare time hours—after school or work.

30 Days Free Trial
Is allowed on every RANGER bicycle. We **prepay** freight charges. If not pleased the trial costs you nothing.

Factory-To-Rider
We sell bicycles made in our own big factories **DIRECT TO THE RIDER**—giving you a **superior** product at greatly reduced cost. Save time, money and trouble by dealing **direct** with our great Factory organization. Satisfaction in every detail guaranteed or money promptly refunded.

TIRES Lamps, Wheels, parts and supplies at half usual prices are also fully described and illustrated in the big free Ranger Catalog.

SEND NO MONEY, but write us **today** for factory prices, liberal terms and if desired Rider Agents Plan.

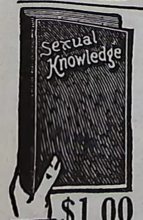
EASY Payments Nine months to pay if desired — at a small advance over our special cash prices.

MEAD Cycle Company Dept B109 Chicago

35 Miles per hour Is Record of this Car Get 1920 plans, ready now

Boys, Build This Car. This nifty little car driven by gasoline motor, can be built by any boy. Parts are furnished by us and are very cheap. Send 26c for building plans and price list of parts showing how to build this lad's car.

SYPHER MFG. CO.
174 Warren St.
TOLEDO, OHIO



SEXUAL KNOWLEDGE

ILLUSTRATED
By WINFIELD SCOTT HALL, M.D., Ph.D.
SEX FACTS MADE PLAIN
What every young man and Every young woman should know
What every young husband and Every young wife should know
What every parent should know
Cloth binding—320 pages—many illustrations
Table of contents, & commendations, on request.

$1.00 Postpaid Mailed in plain wrapper

AMERICAN PUB. CO., 317 Winston Bldg., Philadelphia

from the illustration, the bottom of the oven is raised slightly above the hearth, which permits the heat to circulate beneath the under side. Slides should also be so arranged that a grilled

By setting the tray in the mouth of the furnace you can use the heat for cooking

shelf can be admitted, thus utilizing both the upper and the lower parts. Handles should be attached on either side to assist in removing the oven when warm.

Save Money By Using This Tire Code

Here is a "code" for motorists which, if closely followed, will save many dollars annually in tire expenses:

Keep your tires properly inflated at all times.

Be sure to repair the little cuts regularly.

Prevent blowouts by avoiding severe jolts and by maintaining full pressure.

Have the mud boils cleaned out and repaired at once.

Be careful when inserting tubes.

Avoid sudden stops, quick starts and skidding.

Keep the front wheels in alinement.

Use talc in the casing, but don't use too much.

Avoid ruts and save the side walls.

Don't drive in car tracks.

Apply chains properly and use them only when necessary.

Avoid sharp obstructions.

Remove grease, oil and acids from your tires at once by using a cloth moistened in gasoline.

Examine clincher rims occasionally for irregularities and rust.

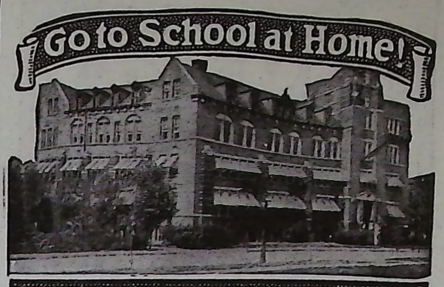
Prevent damage from rust by using graphite.

Carry spare tubes in a bag.

Keep the spare tires covered.

Be sure that there is nothing on the machine that scrapes the tires as they revolve.

Be constantly on the lookout for defects—then you will eliminate most of your tire trouble.



HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED if you lack High School training. You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE This Course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and *meets all requirements* of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY

Most people *idle* away *fifty* hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within *two years*. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

YOU RUN NO RISK So that you may see for yourself how thorough and complete our training is, we invite you to take *ten lessons* in the High School Course—or any course of specialized training in the coupon below—before deciding whether you wish to continue. If you are not then satisfied, we will refund your money in full. *We absolutely guarantee satisfaction.* On that basis you owe it to yourself to make the test.

Check and mail the coupon NOW for full particulars and Free Bulletin.

AMERICAN SCHOOL OF CORRESPONDENCE
Dept. H-753 Chicago, Illinois

TRAINING—THE KEY TO SUCCESS
ASC

Explain how I can qualify for the position checked.

...High-School Graduate	...Lawyer
...Electrical Engineer	...Business Manager
...Elec. Light & Power Supt.	...Certified Pub. Accountant
...Hydroelectric Engineer	...Accountant and Auditor
...Telephone Engineer	...Bookkeeper
...Telegraph Engineer	...Stenographer
...Wireless Operator	...Fire Insurance Expert
...Architect	...Sanitary Engineer
...Building Contractor	...Master Plumber
...Civil Engineer	...Heating & Vent. Engineer
...Structural Engineer	...Automobile Engineer
...Mechanical Engineer	...Automobile Repairman
...Shop Superintendent	...Airplane Mechanic
...Steam Engineer	...General Education Course
...Draftsman and Designer	...Common School Branches

Name.....

Address.....

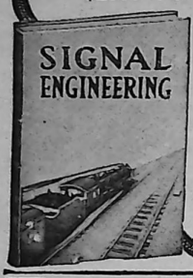
Big Pay

IN FASCINATING NEW

RAILROAD JOBS

Learn at home in spare time to fill a big-pay fascinating job as Signal Engineer. The demand is growing daily for men to install, supervise and maintain signal systems and other safety devices on railroads everywhere. Steady employment; good salaries right from the start.

$2500 TO $5000 A YEAR!



Qualify for one of these jobs! Earn big money! Enjoy every minute of your work! Send today for free information about YOUR great opportunity as a Signal Engineer.

Write for Valuable FREE BOOK

Just write a post-card or a letter NOW and ask us to send you our handsome new book—64 pages, fully illustrated, telling all about this wonderful profession and the big pay jobs awaiting you. Find out how you can quickly qualify in your spare time. This great book is absolutely FREE! Write for it at once. Address

DEPARTMENT OF SIGNALING
Dept. 9203, 1810 Wilson Ave.
CHICAGO, ILL.

Finger Print
Detectives Wanted

MEN are wanted by the government, police departments, corporations, banks, institutions and individuals—these men must be trained Finger Print Men—men who have made this work a profession.

Big Salaries

and big rewards go to these experts because they solve mysteries that baffle the most experienced ordinary detectives. The finger print clew is one that cannot fail because no two people in the whole world make the same mark.

You Can Succeed

in mastering this fascinating, big money-making profession by studying in your spare time at home. Common school education is all you need. A brilliant career is before you. Finger Print experts travel everywhere, see the country, live in the best hotels and have all expenses paid. There is a crying need for such men right now. This profession is not crowded. Get started at once—right now—and be one of the *big men* in the field. Get our free book today.

Mail the Coupon Right NOW!

Fill in this coupon and mail it right now. This may be the big opportunity of your life, so don't waste another minute. When you send the coupon we will send you our

Free Finger Print Book

Tells you all about finger prints—the big opportunities in this profession, and everything you want to know about it. Send the coupon now.

University of Applied Science

Desk 9203. 1772 Wilson Ave., Chicago

Please send me Free Book on Finger Prints and full information about your course of study.

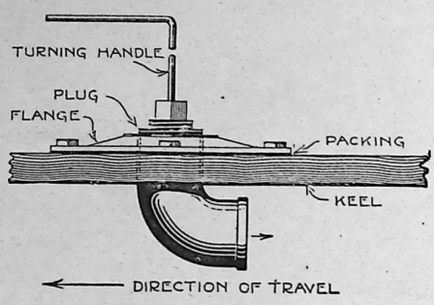
Name.....

Address.....

Age..... *Occupation*.....

This Boat Pump Bails when the Boat Is in Motion

INSTEAD of bailing out the boat before starting, why not install a simple bilge-pump which will empty the water when the boat is under way? It acts when the hull is moving at five miles an hour or more, and needs no



Get rid of that tin-can bailing habit by installing this automatic boat-pump in your launch; it never fails

attention other than to close it before the boat stops.

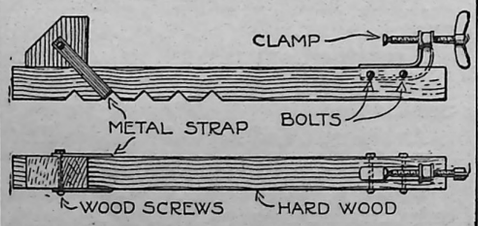
Bore a hole in the keel, and thread in an elbow as shown, directing the horizontal opening toward the stern. You can render the seams water-tight with a flange bolted to the inside of the keel-piece. Fit a plug with a turning handle, and the deed is done.

After the boat is in motion unscrew the plug, and the water in the bilge will be drawn out, due to action similar to that in a siphon. Then close it again with the plug before stopping. This is simple and will never fail.—WINDSOR CROWELL.

An Extension Clamp for the Amateur Carpenter

AN extension clamp is desired by every home carpenter, but he has been prevented from buying it on account of its high cost.

One is easily made, however, from a broken C clamp. With this, all that



Constructing the extension clamp shown here will save you buying the expensive manufactured article

is needed are two pieces of hardwood, two 3/8-in. bolts, two head screws, and a piece of metal strap. By following the accompanying illustration the clamp can be made in a very short time and will give good service for years.

Dimensions cannot be given, since the clamps come in assorted sizes; but they are unnecessary, for the clamp itself can be used and the rest of the contrivance may be made in proportion.—O. J. THIELHART.

New Pleasures In Boating

With a Lockwood-Ash Row Boat Engine new boating pleasures are in store for you.

On your vacation, camping, fishing, picnicking or hunting, you can explore new fields.

You can glide through the narrows, across the riffles, over the shallows.

Young and old can enjoy this practical, economical sport.

Ask for the Lockwood-Ash Booklet; learn about the 30-day trial plan.

LOCKWOOD-ASH MOTOR CO.
2013 Jackson St.
Jackson, Mich.
(55)

LOCKWOOD-ASH MARINE ENGINES

Send for This Book of Model Aeroplanes

Tells how you can build and fly accurate, reduced-scale Models of real Aeroplanes; DE HAVILLAND Battle Plane, NC-4 and others. You can build one easily. Send 10c in stamps NOW and get this 48-page book. **Plans for Model Aeroplanes**—NC-4, 50c; DE HAVILLAND Battle Plane, Curtiss Military Tractor, Bleriot Monoplane, Nieuport Monoplane, Taube Monoplane, 35c each; Cecil Peoli Champion Racer, 25c.

Send for Plans or Book Today.

IDEAL AEROPLANE & SUPPLY COMPANY
Making Model Aeroplanes Since 1911
Cor. Houston and Wooster Sts.
New York

THE ONLY WAY
To Outwit a Crow is with a

MAXIM SILENCER

fitted to your .22 rifle. It deadens the report noise and steadies your aim. Direct from Dealer or Factory, $5.00.

Send 6c in stamps for book of interesting shooting experiences with Maxim Silencer.

MAXIM SILENCER COMPANY
91 Homestead Ave., Hartford, Conn.

Make Your Bike a Motorcycle

The Shaw Attachment Fits Any Bicycle

Makes your old bike a dependable, easy-running, light weight power machine. Compact. Easy to attach. No special tools or knowlege necessary. Battery or magneto. Thousands in use in U. S. and foreign countries. Wonderful hill climber.

FREE BOOK—Write for prices, terms, etc., also about Shaw Motorbicycle, a completely equipped power bike at a big saving.

SHAW Mfg. Co.
Dept. 334,
Galesburg, Kans.

SIMPLE WIRELESS TELEPHONES AND HOW TO MAKE THEM. An elemental book on the principles, construction and use of an arc system of wireless telephony. Price, 25 cents postpaid. Book Department, Popular Science Monthly, 225 West 39th Street, New York City.

NEW-SKIN

To Prevent Infection

New-Skin is a genuine antiseptic.

It has the power of destroying germs of infection.

This is demonstrated by scientific tests.

Use New-Skin promptly, as directed.

"Never Neglect a Break in the Skin"

NEW-SKIN COMPANY, NEW YORK

If You Have a Bicycle You Can Have a Motor-Cycle

Put a STEFFEY ATTACHMENT on your bicycle. Easy to attach, Costs but little. Converts it into a reliable motor-cycle. Send stamp for cirs.

STEFFEY MFG. CO., Dept. S, 5025 Brown St., Phila., Pa.

Be a Jazz Music Master

Yes, you can, even if you have never touched a piano. The Niagara School of Music has perfected a method of instruction which will enable you to play all the popular song hits perfectly by ear. All you need to know is how to hum a tune. Our method—only 20 lessons, which you can master in a little while—will enable you to transform the tune which is running through your head into actual JAZZY music on the piano. All by ear.

It is Easy to Learn

Many masters of Jazz and Ragtime music don't know a note. Be a Music Master yourself. It is easy—the lessons interesting and simple—no tedious ding-dong daily practice, with the *do, re, mi*, until you think you will go crazy—not at all—just 20 brief, entertaining lessons and you have a musical ability at which your friends will marvel. You simply play by ear.

Hum the Tune, Play it by Ear

Hear a new popular song hit, hum the tune, play it yourself. All by ear. Just think how many dull hours this easily acquired ability will make happy, how many friends you will make happy, how popular you will be when you JAZZ the newest song success of Broadway after hearing it. All done by ear.

Be a "Jazz Music Master," and enjoy life. Send for our free booklet, "The Niagara Method" today. It is brimful of interesting and live matter.

NIAGARA SCHOOL OF MUSIC, Niagara Falls, N.Y.

MAIL THIS TODAY

Dept. 18

Without obligation to me, please mail to address below, your Booklet, "The Niagara Method."

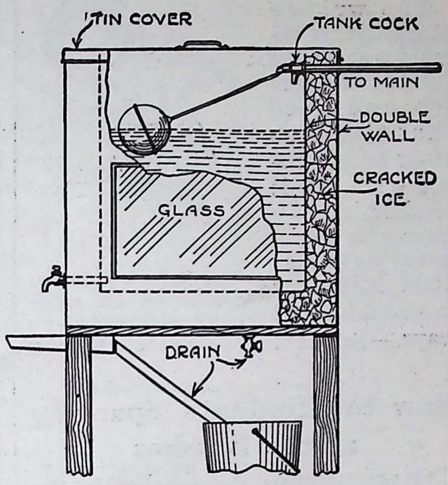
Name.....

Street.....

City..... State.....

This Ice-Water Tank Really Keeps Cold

AFTER July 1st the ice-water tank will become even more popular than it has been heretofore. There are many contrivances of this sort on the



The water tank is entirely surrounded by cracked ice, practically setting the water in a bed of ice

market, but the one illustrated is easily made, even by those with little knowledge of tools, and it will do its work efficiently.

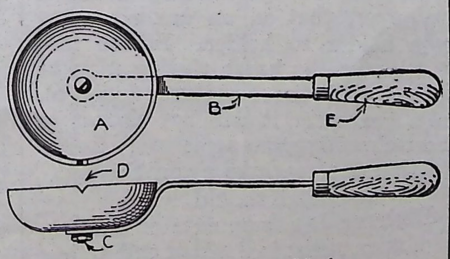
Two tin boxes are fitted one inside of the other, the ice being broken up and placed between them. A simple water trap valve controls the water level, which may be adjusted to any height desired, while a petcock in the bottom allows the water to be drained off after it has melted from the ice.

The tank can be made to look very clean and neat with a coating of white enamel and will repay its slight cost by keeping you cool and comfortable.—ROBERT SCHMITT.

A Handle Ladle Made from a Bell-Gong

AN excellent solder ladle can be made from an old bell-gong, a strip of brass, and a handle.

A is the gong, taken from an old electric bell. *B* is a strip of brass



Make your own soldering ladle from an old bell-gong, a strip of brass, and a handle

fastened to the gong with a small bolt, *E*. The dent *D* is made in the gong with a pair of pliers, so that the molten solder can be poured to a given place.—FERRON HIMES.

Get Into This New Big Pay Field *Now!*

Trained Traffic Experts Earn $2500 to $10,000 a Year and More

Do you want to get into a field of work that is uncrowded—where the job will seek you instead of you looking for it? Do you want to earn $2,500 to $10,000 or more a year? Do you want a position of prestige and independence? Do you want to be one of the biggest—one of the most important men of your company? Of course you do! Then train for traffic work—be a traffic expert.

Transportation today is the country's second largest industry. Four billions of dollars are annually spent in freight charges. Yet perhaps eight of every ten shippers are losing money. And why? Just this: few of the men now in traffic work actually *know* how to route, classify and pack freight to get the cheapest rates. Millions of dollars are being wasted in this way. 100,000 more competent, well-trained traffic men are needed to stop these losses. Be one of these experts and you won't have to look for a job. The job will look for you. You may almost set your own salary!

Thousands of Jobs Open—Train for One in Spare Time

Right now opportunities are unlimited. The great boom in both foreign and domestic trade are crowding the railroads and the Merchant Marine to their carrying capacity. Thousands of men trained in traffic work, are wanted to direct this great flow of trade. Railroads, shippers, and shipowners are literally begging for men. You don't have to quit your job to qualify for one of these splendid positions. Just as we have already trained thousands of others so can we train you—right in your own home, in your spare time. Traffic men of national reputation, the recognized leaders of the field, will tell you all the secrets of Interstate Commerce. The training is thorough, yet easy and interesting. The cost is but a few cents a day. Get in now! A splendid future and a quick success at a big pay job awaits you!

Write for FREE Book

Let us send you "Opportunities and Requirements for Traffic Work." It is a remarkable book that explains in detail this great system of training. It shows how men must be trained in traffic work. It tells all about this wonderful organization of expert traffic men who include such men as T. Albert Gantt, Traffic Manager, Corn Products Refining Company; William Scott Cowie, American Freight Board Committee; Samuel G. Lutz, Vice-President, Chicago & Alton Railroad, and nearly 200 others of equal prominence. They have banded together to correct the big mistakes made daily in shipping freight, that are wasting millions of dollars every year. They are giving their time to train men to right this condition. You will learn how the A. C. A. Advisory Traffic Council renders an indispensable service to the successful traffic men. Get this great, new free book now. It will open your eyes to the splendid opportunities in this fascinating new profession. Mail the coupon, or send a letter now to the

American Commerce Association
Dept T143, 4043 Drexel Blvd.
Chicago, Illinois

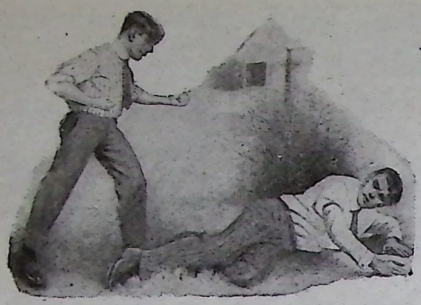
AMERICAN COMMERCE ASSOCIATION,
Dept T143, 4043 Drexel Boulevard,
Chicago, Illinois.

Please send me, without obligation on my part, your free book, "Opportunities and Requirements for Traffic Work." Also tell me how I can qualify as a traffic expert.

Name .....

Address .....

Age..... Occupation.....



It's not a question of bravery or strength, it's knowing how to box. If you don't know how, you've got to take a beating.

Who wants these boxing lessons?

You read the POPULAR SCIENCE MONTHLY partly for entertainment, but principally because you want to improve your knowledge and develop your abilities. You are quite right in thinking that any such effort is a step in the right direction. But isn't there one form of self development in which you are deficient?

Suppose, for instance, someone should attack you. Would you have the knowledge and ability to protect yourself.

Or if someone should use improper language in the presence of your mother or sweetheart, could you teach him a lesson.

Or if someone says, "Let's put on the gloves"; can you do it and really take care of yourself?

Wouldn't you like to know boxing and self-defense—not only for the exercise, but because it will enable you to hold your own if called upon?

There is an easy simple way for you to learn. Marshall Stillman has developed what he calls his "Shortcut" course, a unique original method of teaching boxing and self-defense. He begins with the things you know, such as holding out your hand for a coin, the breast stroke in swimming, etc. He shows you from this simple beginning how to strike correct blows, guard, feint, etc.

Professor Mike Donovan, boxing instructor of the New York Athletic Club, not only endorsed the Marshall Stillman method, but went so far as to collaborate in the preparation of the course. Students from all over the world have taken this course, and within one week some have outboxed older and stronger opponents.

The price of this "Home Study" Edition is only $5. This is a special introductory price for a short time only, the regular price being $10.00. We include instruction in shadow boxing, jiu jitsu and wrestling holds, defense against violent attacks, and Professor Mike Donovan's book on boxing—all without extra charge until further notice.

Frankly now, you don't believe we can teach you boxing by mail, do you? All right, we will mail the complete course on approval. At the end of 5 days' examination, you can either return it or send $5 in complete payment. We take all the risk. Send coupon below, to the Marshall Stillman Association, 461 Fourth Ave, Suite F-3 New York.

Free Trial Coupon

Marshall Stillman Association
Suite F 3, No. 461 Fourth Avenue, New York

You may send me on 5-day approval your complete "Shortcut" Method of Teaching Boxing. I agree to either pay $5 or return it in 5 days. Include extra instruction listed above.

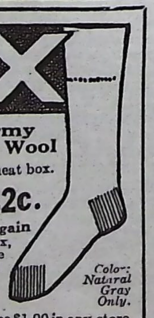
NAME.....

ADDRESS.....

Save on SOX

One Dozen U. S. Army Style—All Wool

All wool medium weight Sox packed in neat box. Sold at terrific sacrifice by manufacturer. Now Per Pair, **Only 42c.**



Color: Natural Gray Only.

Astounding value—never another bargain like this. Fine extra long comfortable sox, made large and roomy like the sox Uncle Sam supplied to our boys during the war. Two styles, plain or elastic top. Wool sox are healthier—that's why the army uses them. Prices now slashed to the limit. Positively not seconds. Regular selling price $1.00 in any store—a clear saving of 58c. a pair for you. Satisfaction guaranteed or money refunded. Now is the time. Order quick.

Dozen Pair Sent Free

(For Examination—no collection charges)—no postage, no delivery charges. Pay only when satisfied this is a marvelous bargain. Don't be deceived into buying cheaper hose of inferior quality at a lower price.

SEND NO MONEY

Just mail your name and address and state size. Sox will be mailed at once. Offer only good in U. S. Write today. Color—natural gray only. If no preference of style is stated we will send plain top.

Order Now--At Once--Our Risk!

Get twelve pair. Will keep you comfortable for a long while—and you can't get any more at this low figure after these are gone. Smallest order we can fill is six pair. You pay postman $2.75. For twelve pair you pay only $5.

It will cost you nothing to be convinced. Satisfaction guaranteed or money refunded. Order now. Mention size. Address Dept. 903.

Twenty years of satisfying customers
References: Dun or Bradstreet

BACH BROS. 11500 Michigan Av. Dept. 903, CHICAGO, ILL.

Attach a Screw-Eye to Your Key-Ring

DID you know that the ordinary screw-eye used by carpenters for fastening hooks, etc., is an excellent substitute for the corkscrew?

The writer adopted this ingenious scheme a number of years ago, and since that time has never been without one. It is invaluable as an emergency corkscrew, as well as a first-aid in other mechanical ways.—R. GILL.

The ordinary screw-eye makes an excellent substitute for the corkscrew

How to Eliminate Sparking at the Brushes

SPARKING at the brushes in the operation of electrical machinery, especially D.C. machines, is a very common trouble. Faulty design or construction, and perhaps errors in assembling, are some of the causes; but the majority of cases may be classed as operating faults.

Of the purely electrical causes, the most common is the wrong position of the brushes. This may be due to the brush gear not being securely clamped and thus working around into the wrong position. Where a number of brush-holders are clamped on a single stud, alinement of the holders is essential for good commutation. Brush-holders out of line with the line of the commutator segments will also cause sparking.

Faulty field coils, due to ground or a partial short circuit, will also cause poor commutation. Re-insulation will be found necessary. A partial short circuit in one of the field coils may be found or located by noting which of the coils is the coolest.

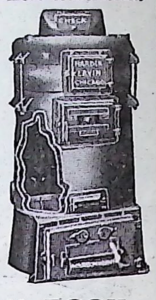
The most frequent cause of sparking is overloading. With an ammeter in the circuit this can easily be noted. Overload sparks extend the entire width of the brushes. If the overload is increased, the sparks may cause a flash-over, that is, an arc extending from holder to holder. In the case of a motor the brush rigging may be burned and the armature damaged. In a generator it will act similar to short-circuiting the armature. Before starting the machine again the cause of the overload should be removed.

High or low commutator bars or high mica result in flashing and arcing, when not only the faulty bar but adjacent bars will become rough and blackened. High segments can be eliminated by turning or grinding the commutator. High mica can be cut off and recessed.

Dirty and oily commutators are also a common cause of sparking, and the remedy is obvious.

BURN LESS COAL

WITH an improved all-cast pipeless furnace you can cut your coal bills in two. This efficient, basement installed heating plant heats and ventilates the entire home. It burns any grade of coal more economically than a stove. It needs no expensive piping or other equipment. Anyone can install it in a day. They are described at our wholesale prices in our Handy Man Book. Send for it.



Do Your Own Plumbing and Heating by the Cut-to-Fit Method

By our new plan anyone can install a complete plumbing or heating plant in his own home. Send us a rough sketch with measurements. Our Engineers will draw your plans, furnish information and see that the supplies you order come CUT-TO-FIT your needs. No waste of time, labor or unused materials. Only a few simple tools necessary. *Send for*

THE HANDY MAN BOOK

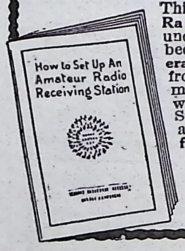
It will show you how. It will tell you just what to order and what it will cost at our wholesale prices. It contains plans and useful information for every builder, property owner or contractor. It will convince you. It will increase the value of your property 50%. You can do the work yourself.

We have spared no effort or expense in the preparation of this valuable book. To keep from sending it broadcast to uninterested persons we request a temporary deposit of 25c which will be refunded with your first order.

Send for it To-day.

HARDIN-LAVIN CO.
Is guaranteed by 40 years' business at
4526-36R Cottage Grove Ave., Chicago

How to Set Up An Amateur Radio Receiving Station.



This book explains the principle of **Radio Telegraphy** so anyone can understand it. Tells how you can become an **Amateur Radio Operator** and get wireless messages from everywhere. Explains the most convenient and inexpensive way to get a Radio Receiving Station, and how to set it up and operate it. **Ten cents spent for this book may save you many dollars and disappointments later on.** *Send 10 cents in stamps now and get your copy.*

deForest Radio Tel. & Tel. Co.
1393 Sedgwick Ave., New York City

"ASK ANYONE WHO HAS USED IT"

Brandes Wireless Headset

TRIAL OFFER Buy a Brandes Superior Headset and use it critically for ten days. Then, if it doesn't come up to our claims or your expectations, return it and your money will be cheerfully refunded. Test it—compare with others—for sensitiveness, clearness, distance. Prove for yourself the fine quality, the "matched tone." The two diaphragms toned exactly alike, strengthen the signals and prevent blurring. Used by many U. S. Gov't experts and experts abroad; by colleges and technical schools; and by professionals and amateurs everywhere.

"Superior" Set 2000 ohms **$7**

Send 4c for Catalogue R

C. BRANDES, Inc., 32 Union Sq., Room 813, New York, U. S. A.
Wireless Receiver Specialists

BUCHSTEIN'S FIBRE LIMB

soothing to your stump,—strong, cool, neat, light. Easy payments.

Braces for all deformities.

Guaranteed 5 Years
Send for Catalog Today.
P. BUCHSTEIN CO., 113, 6th St., S., MINNEAPOLIS, MINN.

A Magic Clock for Home Entertainment

FOR mystifying your audience the magic pointer is a "sure-fire hit." It is used in combination with a large clock dial having a center pin, which the pointer spins upon, and stopping at any number indicated. It tells the day of the week, the time of day, number on a card, etc., the numbers all being controlled by the clock's operator. The pointer works upon the gravity principle; that is, the lead weight *E* always comes to rest at the lowest point. Since the lead weight can be moved in a circle to different points, it is easily seen that the relation of the lead to the center of the pointer determines its position on the clock dial.

The performer is able to gage the pointer's stop by the action of spring *M* passing over a series of twelve holes

The performer spins the clock hand and demands it to stop at a certain numeral asked for by the audience. How does he do it?

in *B*. To start with, the pointer is set at a certain number, and if any other number is required all the performer does is to turn the center portion of the pointer over a required number of holes.

The actual making of the clock can best be understood by following the details set forth below. The parts are made from odds and ends of old material.

A is the pointer. It is filed down from $\frac{1}{32}$-in. sheet brass. The $\frac{1}{4}$-in. hole in its center must balance the pointer accurately.

B is a piece of $\frac{1}{32}$-in. sheet brass, equally spaced holes $1\frac{1}{8}$ in. from its center. This piece is sweated to *A*, as shown in the diagram, the $\frac{1}{4}$-in. holes, of course, being in line.

C is a curtain-rod end. Attached to *C* is the index spring *M* that revolves over the index circle *B*. The square hole fits over the square end of the spindle *L*. *D* is another curtain-rod

How to Read Blue-Prints and Plans.

What You Should Know About Architectural Drawing.

How to Use the Steel Square Successfully.

What You Should Know About Carpentry and Building.

How to Build a Frame or a Brick Structure.

How to Know Material and Select the Best.

How to Build of Concrete and Steel.

How to Care for Tools.

What You Should Know About Sheet Metal Work.

How to Be a Successful Building Superintendent.

What You Should Know About Heating and Ventilating.

How to Write and Read Building Specifications.

What You Should Know About Water Supply and Drainage.

How to Estimate the Cost of a Building.

A Thousand Things You Ought To Know

EVERY day in your work you get up against new problems—sometimes it is only some old 'sticker' coming in a new way. Just the same, though, it takes a lot of time to figure them out. **Don't do it.** Here's everything worked out for you. Every problem big or little that you will meet in a day's work. Hundreds of new ideas and better ways of doing things. Hundreds of ways the other fellows are making money. Hundreds of ways **you** can make more out of the same work you are doing now.

The old days of hit-or-miss experience are passed. You have got to **know** if you want to keep in the running now. A little of your spare time and the Cyclopedia of Carpentry and Contracting will put you 'way ahead of the rest. See our FREE trial offer and easy payment plan below.

Carpentry and Contracting

Five great big volumes flexibly bound in genuine American Morocco with 2138 pages and more than 1000 blueprints, plans, pictures and diagrams. It is the newest, most complete, most practical work of its kind ever published. Twenty-five well known experts prepared these great books, gathering the material from hundreds of different sources. Every man in the shop and on the job should have them. Written in such plain language that anyone can understand them.

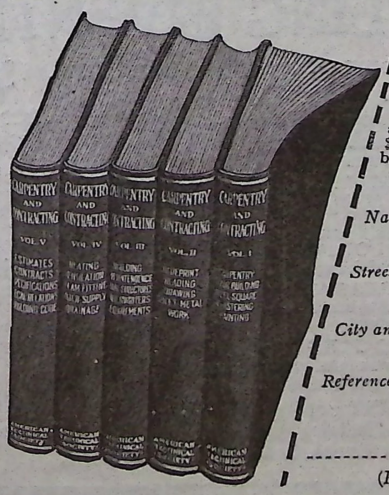
TELLS ALL ABOUT

Carpentry (including everything from the raw timber and tools to the trimming and turning over to the owner); Stair-Building; Steel Square; Plastering and Painting; Mechanical Drawing; Blue Print Reading; Architectural Drawing; Sheet Metal Work; Building Superintendence; Underwriters' Requirements; Heating and Ventilating; Steam and Hot Water Fitting; Sanitary Appliances; Water Supply; Drainage and Venting; Domestic Hot Water Supply; Hardware; Estimating; Contracts and Specifications; Legal Relations; Building Code; General Index and Review Questions and Index to each volume.

FREE Examination
10 Months To Pay

Send the coupon for these great Carpentry and Contracting books TODAY. You can't afford to be without them and you don't take any risk at all. The coupon brings the whole set by express collect for a week's free examination. Use the books a week and send them back at our expense if they don't please you. If you like them send us only $2.80 and $2.00 each month thereafter until $19.80 is paid. If you prefer to pay cash with order send only $18.00. The return privilege holds good just the same. Send the coupon NOW. Remember—sending for the books does not obligate you to buy.

American Technical Society, Dept. G-203, Chicago



American Technical Society,
Dept. G-203, Chicago

Please send me the five volume Cyclopedia of Carpentry and Contracting, shipping charges collect. I will send you $2.80 within seven days and $2.00 a month thereafter until $19.80 has been paid, or return the books at **your** expense.

Name _____

Street and No. _____

City and State _____

Reference _____

_____

(Please fill in all of these lines)

"I certainly will increase that stenographers' salary; his letters are perfect"

Your Salary Can Be Increased
Probably Doubled by
The "New Way" in Typewriting

Typewrite 80 words per minute or more and you will draw big pay. Wherever you are, increased output of finished work will bring the big money—good promotions—the private secretaryships—eventually the executive positions. Stenographers who are real Typists are wanted by Employers everywhere. Poorly trained in typewriting means poorly paid on pay-day. Expert ability means big money—success.

LEARN BY MAIL
10 EASY LESSONS

80 to 100 Words Per Minute
or Money Returned

The trouble hitherto has been that stenographers had no way to improve their typewriting. Ordinary methods left them stranded with but a 30 to 40 word ability. There was no way to overcome the handicap.

Now the "New Way" has changed all this—it opens the door for every stenographer to high speed in typewriting—to perfect accuracy—to great ease of operation—to promotions and Big Pay.

Based upon an absolutely new idea—special gymnastic exercises for the definite, cultural training of the fingers *away from the machine*. Marvelously successful.

Ten simple lessons, easily completed in spare time. Your daily typewriting improves from the very start. Cost low. **Binding guarantee—no pay retained unless expected results are fully realized.**

THE TULLOSS SCHOOL
3673 COLLEGE HILL, SPRINGFIELD, OHIO

Please send me your free book on Typewriting. This incurs no obligation whatever on my part

*Name*_____

*Address*_____

FREE!! New Way booklet describes this revolutionary new system in full detail—shows you the way to a transformed ability, double or trebled salary. Write for it today. FREE.

THE TULLOSS SCHOOL
3673 College Hill :: Springfield, Ohio

BIG EARNINGS EASY

In this new, rich, unlimited field. Here's something entirely clear of the "old and and beaten path"—big, quick, easy money, and a lucrative business of your own. Our exclusive representatives—some with NO OTHER SELLING EXPERIENCE — have doubled and tripled their previous incomes. No reason why *you* shouldn't. Not at all hard. We have something every car owner needs—Can't buy from anyone else—Made only in our own factory.

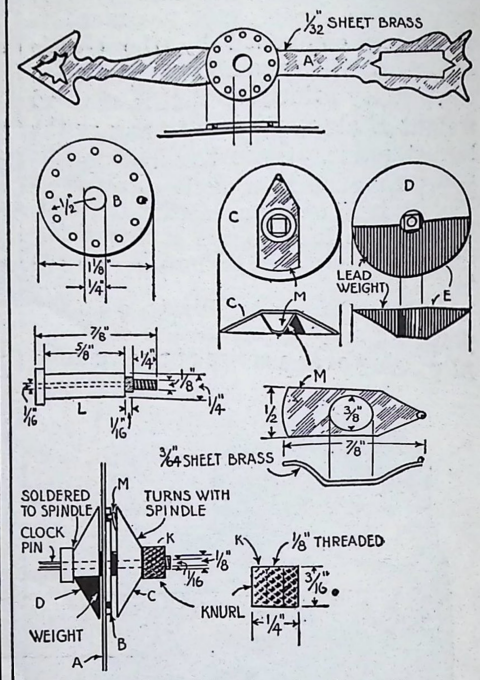
5 STARTLING INVENTIONS

Choose your own **exclusive territory.** Sell direct, wholesale, or both. Our line is a real winner—easy to demonstrate, easy to sell. Your own and surrounding counties may be open now. But if you want to share in these profits, then don't wait—not even another minute. Write TODAY for complete information. Post card will do it. Send by next mail—*sure.*

1. The one perfect SPARK INTENSIFIER. Fires any plug. Banishes spark plug trouble. Saves gas. 100,000 already in use.
2. A safety-insuring and comforting-making STEERING DEVICE FOR FORDS. Simple. 100% efficient. Makes driving a pleasure.
3. A hot-firing, UNBREAKABLE SPARK PLUG with three strictly exclusive, practical, and sales-pulling features.
4. A "VISIBLE" SPARK PLUG with all exclusive features of above-mentioned plug and equipped, also, with spark intensifier.
5. A HANDY FASTENER for non-skid chains. Locks and holds with a "bull dog" grip. Saves the motoring public an enormous loss.

JUBILEE MFG. CO.,
529 Sta. C,
OMAHA, NEB.

that contains the lead weight *E* held therein by shellac. *D* is soldered to the spindle *L*. *E* is the lead weight, this being made by first filling *D* with hot lead, which is removed and sawed in half after it has cooled. *K* is the knurled nut that holds *C* and *D* together on the pointer. *L* is the spindle made from 3/8-in. drill rod with



By carefully following the above diagram and the description in this article the clock dial and pointer can be easily made from odds and ends

a 1/16-in. hole in it that fits freely over the pin in the center of the clock dial.

On *L* under the thread portion is a square part that fits into the square hole in *C*. This is necessary in order that parts *C* and *D* will turn together on the pointer *A*. *M* is a brass spring that is soldered in *C* and acts as an indicator to the performer as he feels it pass over the holes in part *B*. The dimensions given can be changed to meet individual needs.

Experimenters and amateur mechanics will get a lot of pleasure in making and using this piece of mystery apparatus.—R. S. MYERS.

A Machine that Polishes Silverware at Home

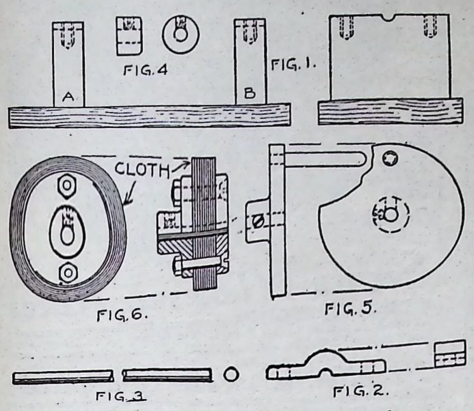
SHOULD the reader at some time or other decide that some of his household goods need a polish, why not at the same time decide to do the polishing himself?

Results make the work interesting, and to make a polishing machine good enough for such a purpose is an easy task.

The sketches accompanying this article explain fully the various parts and their functions.

First, refer to Fig. 1, which shows the base, consisting of two blocks of wood "A" and "B," each having a half hole as shown at end view. Then

comes the cap shown at Fig. 2. Of course there are two of these caps. At Fig. 3 is shown the spindle, and this is made either from a piece of

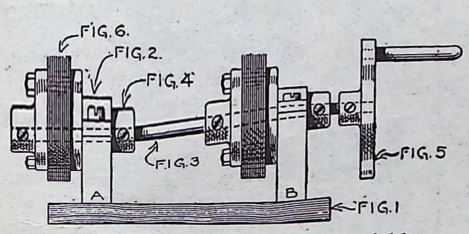


The figures in the illustrations above and below describe in detail the various parts from which the machine is made

pipe, as shown, or a piece of cold rolled steel if desired.

Four washers, as shown at Fig. 4, are used to take up the thrust of the spindle, and these can be made of wood or steel as desired.

The driving handle and disk shown at Fig. 5 does the necessary turning, and a treadle design in place of the



Silverware and brass are quickly polished with this home-made polisher

crank can be made if considerable work is to be done.

Last come the wheels. They are easily made in the manner shown at Fig. 6.

Assemble all of the parts, as shown in the lower diagram, and you have a homemade polishing-machine capable of good work.—J. W. MOORE.

Making a Wash Bottle for Test-Tube Cleaning

A WASH bottle, which is used in every chemical laboratory to clean test-tubes, can quickly be made from materials picked up about the laboratory. It consists of four parts: two lengths of glass tubing, a two-holed cork, and a bottle of any shape or size. One of the glass tubes should be from three to four inches longer than the bottle, the other about 5 in. long.

The longer tube must be bent near its top, as shown in the illustration, and the end of the shorter tube drawn out to a fine point. Both tubes are placed through the two-holed (rubber) stopper, so that the shorter tube extends about ½ in.

In a Junk Pile of Tires Oldham Found His FORTUNE

Earned $2200.00 In Four Months—

So can you. Oldham was a telegraph operator at a telegraph operator's pay and 53 years old when he found his fortune in a junk pile of old worn out tires. One day he read in an advertisement similar to this, of the money making opportunities in the Automobile Tire Repair business. He answered the ad, and got Haywood's story—all the facts. He read what others had done—how hundreds of men are making upwards of $4,000 a year making old tires new, repairing punctures, blow-outs, retreading the millions and millions of automobile tires. He determined to act. He wrote me for my proposition. I sent it. Then he bought a Haywood outfit and started in business in his old home town. In 4 months he made $2200, as much as he made in 2½ years as a telegraph operator.

HAYWOOD'S TIRE SURGERY Gives New Life To Old Tires

You Can Make $2500.00 to $5000.00 a Year

Think! You men who are seeking a permanent, big paying business of your own. The possibilities in the same field that is making OLDHAM a fortune. It is a field practically new. Uncountable millions of automobile tires are thrown in the junk pile; tires that can quickly and profitably be remade by Haywood's Tire Surgery and Haywood Equipment—tires that can be put back into service and run 4,000 to 5,000 more miles.

You can do it, equally well or possibly better—Oldham's record of money making—It's being done every day; its facts within reach of every ambitious, determined man. If you are that calibre you will sit down now and write Haywood for full particulars. When you get all the information you want, you will jump at the opportunity. You will see an opportunity bigger by far than we can hope to tell you in the limited space of this magazine.

No Experience Necessary—I'll Teach You

No previous training, no apprenticeship is required to enter this business—not even the faintest knowledge of tires. If you have a little mechanical turn of mind, you can quickly become an expert. We teach everything. YOU LEARN IN A WEEK in my Free Training School.

Tire repair jobs—make old tires new. You'll know how to repair every kind of cut, gash, bruise, that can happen to any tire. You become a Tire Surgeon, that's what you'll be, and the chance to make money is something wonderful.

Free Book Gives All Facts Write Me Today. Mail Coupon

I have ready to mail you the day I get your request, a fascinating book—all about tires—how to repair them by the HAYWOOD METHOD—how to start in business—how to build up trade—what to charge. You needn't write a letter—just tear out the coupon right now, fill it in and mail. In 48 to 72 hours you can have the whole proposition right in front of you. It's a case of walking right into $2500 to $4000 a year and up. Use coupon, or send a post card.

M. Haywood, President
HAYWOOD TIRE & EQUIPMENT CO.
1255 Capitol Ave. Indianapolis, Ind.

M. Haywood

Earns $800 Month

This is **E. T. Buchmann**

He is a Tire Surgeon at Chicago. He says: "Am earning $800.00 per month, and confining myself solely to re-building of Tires by Haywood Method."

$6,500.00 Home Paid For

John W. Blair, Toledo, Ohio, says: "When I started three years ago, I had just $50.00 left after paying for my outfit. I now have a $6,500 home paid for, $1,000 in one bank, and deposits in several others.

Clip and Mail TODAY

M. HAYWOOD, President
HAYWOOD TIRE & EQUIPMENT COMPANY
1255 Capitol Avenue, Indianapolis, Indiana

Dear Sir:—Please send me by return mail your free book on the new Haywood Tire Surgery Method and the details of your free school for tire repairing.

*Name*_____

*Address*_____

Step Up to a Better Job!

That better job and the bigger pay that goes with it—the job *you* want—is within your reach. It's only a step to the really big jobs from where you are. That step is simply "knowing how." The practical books for self-training described below will give you that "know how." They are the steps by which you can reach the job you want.

Some of the best authorities in the world wrote these books in plain, everyday language. Anyone who can read and write English can understand them. Thousands of pictures, diagrams, etc., make difficult points as plain as day. Over 1,000,000 volumes have been sold.

Pay-Raising Books at Greatly Reduced Prices

Automobile Engineering, 6 volumes, 2600 pages, 2000 pictures. Was $30.00.....Now $21.80
Carpentry and Contracting, 5 volumes, 2138 pages, 1,00 pictures. Was $25.00.....Now 19.80
Civil Engineering, 9 volumes, 3900 pages, 3000 pictures. Was $45.00.....Now 29.80
Accountancy and Business Management, 7 volumes, 3000 pages, 2000 pictures. Was $35.00. Now 24.80
Fire Prevention and Insurance, 4 volumes. 1500 pages, 600 pictures. Was $20.00.....Now 15.80
Electrical Engineering, 8 volumes, 3800 pages, 3000 pictures. Was 40.00.....Now 24.80
Machine Shop Practice, 6 volumes, 2300 pages, 2500 pictures. Was $30.00.....Now 19.80
Steam and Gas Engineering, 7 volumes, 3300 pages, 2500 pictures. Was $35.00.....Now 21.80
Law and Practice (with reading course), 13 volumes, 6000 pages, illustrated. Was $72.00.....Now 44.80
Telephony and Telegraphy, 4 volumes, 1728 pages, 2000 pictures. Was $20.00.....Now 14.80
Sanitation, Heating and Ventilating, 4 volumes, 1454 pages, 1400 pictures. Was $20.00.....Now 14.80
Practical Accounting, 4 volumes, 1840 pages, 800 pictures, etc. Was $20.00.....Now 14.80
Drawing, 4 volumes, 1578 pages, 1000 pictures, blueprints, etc. Was $20.00.....Now 14.80

Send No Money
Shipped for 7 Days' Trial

Write the name of the books you want on the coupon and mail it today. We will send the books at once, express collect, and you can use them just as if they were your own for a whole week. If you decide you don't want to keep them, send them back at our expense.

50c a Week

If you like the books, as thousands of other men have after examination, just send us $2.80. You can send the balance of the special reduced price the same way—$2.00 each month (50 cents a week). Send $3.00 a month if you order the Law books.

Step up to a better job with bigger pay. MAIL THE COUPON NOW. It's your first step.

AMERICAN TECHNICAL SOCIETY
Chicago, U. S. A.

American Technical Society, Dept. X-203, Chicago, U.S.A.

Please send me set of .....

.....

for 7 DAYS' examination, shipping charges collect. I will examine the books thoroughly and, if satisfied, will send $2.80 within 7 days and $2 each month ($3.00 for Law) until I have paid the special price of $..... If I decide not to keep the books I will return them at your expense within one week.

Name.....

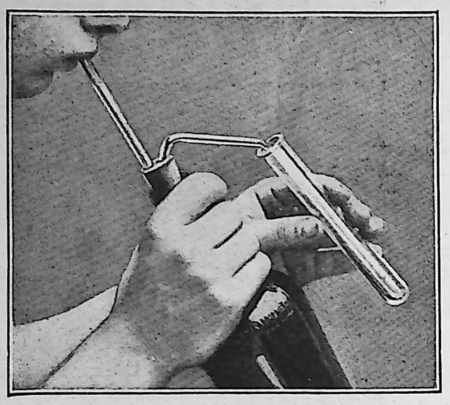
Address.....

Reference.....

(Please fill out all lines.)

below the cork and the long tube, coming to within ½ in. of the bottom of the bottle. Now carefully draw out the cork with the glass tubes, fill the bottle with tap or distilled water, and replace the cork.

If a current of air is blown into the short tube, a fine spray will be

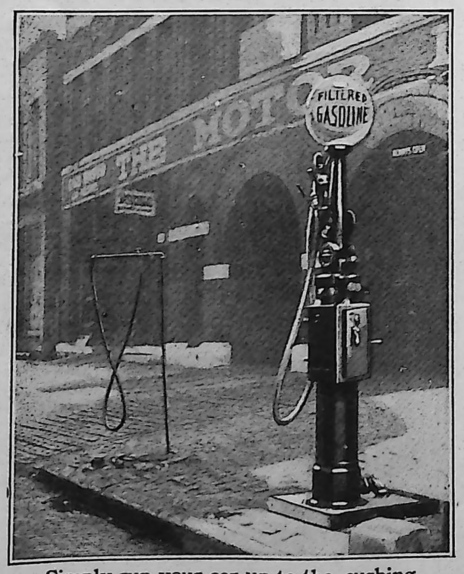


Here is a quick and sure way of cleaning test-tubes. Only a few minutes are consumed in making the apparatus

ejected from the nozzle. The force of the spray is strong enough to clean the majority of test-tubes. When only a few cubic centimeters of water are required, tilt the bottle and allow the water to run out of the shorter tube.—ERNEST BADE.

Piping Water to the Curb for the Motorist

HERE is the novel way in which an enterprising garage-keeper supplies water for automobilists. Instead of the motorist having to go in-



Simply run your car up to the curbing and turn the water into the radiator

side and hunt up a can (the usual way), he here has the water handy at the end of a flexible hose.

Needless to say, this contrivance soon paid for itself by increased trade, for the simple reason that motorists stop their cars at the most convenient place for supplies.—DALE VAN HORN.

Send only $1

Be Your Own Dealer

Secure Wholesale Rates

INTRODUCTORY OFFER so you can try these famous goods by mail. Price $6.63 for the set. On receipt of $1.00 we send three splendid shirts and handsome silk neck-tie parcel post C. O. D. $5.63 and postage.

Six Months' Wear Guaranteed

These shirts are made of finest white percale shirting fabric with neat stripes of blue, black and lavender. One shirt of each color to the set. Cut in the popular coat style, cuffs attached, hand laundered and very fashionable. Standard sizes 14 to 17. Choose your color of tie. Money back if not pleased. Save time, order now and

WRITE *for New Catalog* DURATEX

as good as a smart New York store and get wholesale rates on fashionable hosiery, underwear, neckwear, soft and stiff cuff dress and sport shirts. Guaranteed for six months' wear or new garments free. You owe your pocketbook to send for it and **be your own dealer** and save dealers' profits on all you buy. It's the only real way to save.

Wearer agents make extra money in spare time
GOODELL & CO., 550 DURATEX BLDG., NEW YORK
Largest mail order wholesale haberdashery house in the world

LEARN MUSIC WITHOUT A TEACHER

New way. Any instrument you like now made easy. Piano, Organ, Violin, Banjo, Mandolin, Cornet, Harp, 'Cello, Ukelele, Saxophone, Piccolo, Clarinet, Flute, Trombone, Guitar, or Singing, all by note. Don't even need to know one note from another to begin. Lessons by mail in simplified chart and picture form take you step by step, and make every step as simple and clear as A B C. Prepared by foremost musicians. Over 225,000 people, from seven years old to seventy, have learned through these simple lessons. Many have become teachers. This new method succeeds even after old methods of personal instruction fail. Entire course on trial---you to be the judge and jury; averages only a few cents a week if satisfied and nothing whatever if not.

Free book shows how simple and easy it is and gives full information. Special introductory offer if you answer at once. Write today, then judge for yourself. Instruments supplied when learning, cash or credit. No obligation. Address

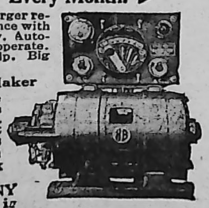
U. S. SCHOOL OF MUSIC
83 Brunswick Bldg. New York City

BIG PROFITS for YOU in HB BATTERY CHARGING

Battery charging is a wonderfully profitable business that you can handle without any special electrical or mechanical experience. With no better opportunity than yours, many HB owners are clearing

$100 to $150 EXTRA PROFIT Every Month.

Some even more. This HB 500-watt Charger recharges 1 to 8 auto storage batteries at once with current cost of only 10c to 15c per battery. Autoist pays 75c to $1.50. Anyone can operate. Requires little attention and no extra help. Big profits quickly and easily made.



$15 Puts This Money-Maker in Your Garage

Balance in easy payments. Earnings should easily more than meet all payments. Write for full particulars or send $15 first payment with trial order. Delay means lost profits. Order charger at once from this ad. No risk. Absolute money-back guarantee. Do it today.

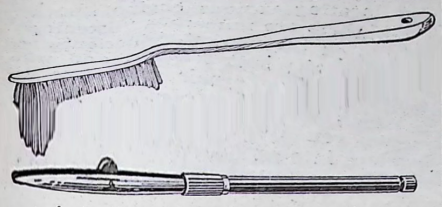
HOBART BROTHERS COMPANY
Box S31 Troy, Ohio

$10.00 FOR YOU. How would you like to make $10.00 a week during your spare time? Others are doing it by representing POPULAR SCIENCE MONTHLY. Why not *you?*

Popular Science Monthly 225 West 39th Street, New York

A Tooth-Brush Makes a Good Drawing-Pen Cleaner

THERE is no better cleaner for the mechanical drawing-pen than a tooth-brush. For this purpose a ten-



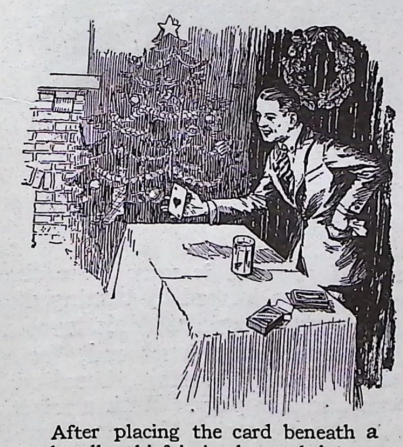
A tooth-brush makes an excellent pen-cleaner, for it leaves no lint and does the job quickly and efficiently

cent one will do. The same plan applies to any kind of pen you may be cleaning.—J. W. MOORE.

How to Make a Card Dissolve into Water

A PLAYING card is taken from a deck, placed under a handkerchief, and then allowed to drop into a glass of water, where it disappears. A member of the "watch committee" performs the "dropping of the card," which adds further to the parlor mystery.

The feat is accomplished by having on the table a small piece of celluloid the exact size of a playing card. After a card has been chosen, it is placed face downward on the table, so that it will rest on top of its transparent



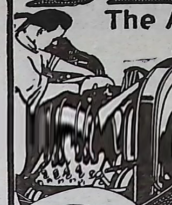
After placing the card beneath a handkerchief it is dropped into a glass of water, where it disappears

duplicate. Picking up celluloid and card together, they appear as one, since the face of the real card is distinctly seen through the transparent celluloid.

Under a handkerchief the real card is slipped up the performer's sleeve, while the celluloid duplicate is allowed to remain. It is this blank duplicate that the audience feel and see outlined beneath the folds of the kerchief, and of course in the water it cannot be detected.

The performer then quickly removes the card from his pocket, diverting the eyes of the spectators from the apparently empty tumbler—which can then be removed.—MERRITT HALE.

DETROIT
The Auto Center is the Logical Place To
LEARN AUTO AND TRACTOR BUSINESS



There were more than seven million cars and trucks licensed in the United States during 1919. Thousands more are being added to this astounding number every day and still the demand is far ahead of production. *And Detroit is the Heart of this tremendous industry.*

Auto Factories Endorse School

In fact, they assisted us in the arrangement of our present course. They loan us their latest chassis and give our students the fullest co-operation. The Auto Factories are constantly calling on us for graduates—they know the kind of men we turn out.

EARN $100 TO $400 PER MONTH

Trained men are always needed and can get the big high-salaried jobs. Trained men are in big demand and we constantly have a greater demand than we can supply—both from Detroit and throughout the country. There are thousands of good locations for garages and the big factories help our graduates get these fine locations. Service stations are after our graduates to fill positions as managers, foremen, etc., at big salaries. Auto owners prefer to put their cars in a competent mechanic's hands and our graduates have no trouble getting business and holding it. Our graduates who are in business make $5,000 to $10,000 and more yearly.

What We Teach

A complete course in Auto Electrics is an important part of our course. This subject is so thoroughly taught that our students have no difficulty in locating and correcting any trouble in auto electric systems. A complete tractor course is also included without extra charge. Brazing and Welding and Tire Repairing are thoroughly covered in two separate courses. M. S. A. S. graduates are trained through doing the actual work on cars, trucks and tractors.

HUDSON MOTOR CAR COMPANY
DETROIT, MICH., U.S.A.
The Michigan State Auto School, in our opinion, is the finest institution of its kind in the country. In fact, we endorse its method of instruction.
The Michigan State Auto School ranks highest in the standard of schools. Its equipment and personnel is second to none. This school is thought very highly of by the automobile men of Detroit and is considered one of the most efficient schools in the country.—HUDSON MOTOR CAR COMPANY.

Money-Back Guarantee
We guarantee to qualify you for a position as chauffeur, repairman, tester, demonstrator, auto electrician, garageman, automobile dealer or tractor mechanic and operator, paying from $100 to $400 monthly or refund your money.

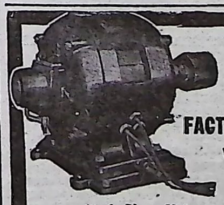
Ask for Catalog—Write Today
Get a letter on the way to us Right Now asking for our new 176-page catalog. It tells the complete story of our school and our several Courses, Gives the names and letters from our graduates who have made good because of the training received here at old reliable M. S. A. S.—"The Detroit Auto School." *Get a catalog NOW! Don't Delay! Don't Wait! Write NOW—Today!*

DETROIT THE HEART OF THE AUTO INDUSTRY — MICHIGAN STATE AUTO SCHOOL — THE AUTOMOBILE CENTER OF THE WORLD — 50 COMMERCIAL FACTORIES — 1400 ACCESSORY FACTORIES

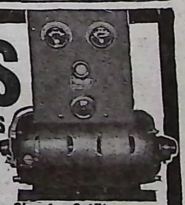
MICHIGAN STATE AUTO SCHOOL
"Most Progressive Auto School in America"—"In the Heart of the Auto Industry"
583 Auto Building, 687-89-91 Woodward Ave. Detroit, Mich., U.S.A.

Pilliod
TOOL CASES EXCEL
Machinists, Tool Makers and Carpenters find them most satisfactory in construction, appearance, service and price. Immediate shipment.
Booklet describing 20 styles on request.
The Pilliod Lumber Co.
Dept. A, Swanton, Ohio

ASBESTOS
We are miners and shippers of Crude Asbestos in any quantity. We produce all grades at our world famous BELL ASBESTOS MINES, in Canada. We also card fibres, spin yarns, weave cloths, and make all sorts of Asbestos products.
For anything you want in Asbestos, turn to
KEASBEY & MATTISON COMPANY
Dept. S-4. AMBLER, PENNA., U. S. A.
Owners of the world's largest Asbestos Mines



NEW MOTORS
FACTORY GUARANTEED - ALL SIZES - IN ORIGINAL BOXES
Your Opportunity To Buy New Guaranteed Electrical Apparatus of Standard Manufacture.



Single Phase Motors
110-220 volts, A. C., 60 cycle, 1800 R. P. M. with pulley
1/4 H. P., 110 volts, induction, full load start - - $24.50
1/2 H. P., 110-220 volts, induction, full load start - $38.50
1/2 H. P., 110-220 volts, repulsion, for compressor $46.50
1 H. P., 110-220 volts, repulsion, with sliding base - - $67.50
2 H. P., 110-220 volts, repulsion, sliding base $108.50
3 H. P., 110-220 volts, repulsion, sliding base $124.50
5 H. P., 110-220 volts, repulsion, sliding base $164.50

Charging Generators
Suitable for all lighting Battery Charging and Power Requirements.
6 volts, 10 amp. $16.50
15 volts, 10 amp. $21.00
40 volts, 6 amp. $24.50
110 v, 2½ amp. $24.50
40 volts, 12 amp. $38.50
110 volts, 5 amp. $38.50
40 volts, 25 amp. $58.50
110 volts, 10 amp. $58.50
Moving Picture Arc Generator $85.00

Polyphase Motors
2 and 3 phase, A.C., 220 v, 60 c, 1750 RPM., complete with base and pulley.
½ H. P. - $42.50
1 H. P. - $59.50
2 H. P. - $72.50
3 H. P. - $84.50
5 H. P. - $102.50
1 H. P., high speed, 3600 R.P.M., 220 v 2 phase only - $36.50

Battery Charging Outfits
To operate on A. C., 60 cycle, single phase voltage as specified.
110 volts, A. C., 100 watt, 24 volts, without switchboard $40.00
110 volts, A.C., 150 watts, 30 volts, with switchboard $68.50
110-220 volts, A. C., 250 watts, 24 volts, without switchboard - $75.00
220 volts, A.C., 300 watts, 30 volts, without switchboard - $85.00
110 volts, A.C., 375 watts, 36 volts, without switchboard - $85.00
220 volts, A.C., 500 watts, 48 volts, with switchboard $110.00
110 volts, A.C., 750 watts, 72 volts, without switchboard $125.00

WRITE FOR CATALOG. BARGAINS IN MOTORS AND GENERATORS

SPECIAL 1/4 H.P. 110 volts A.C., 60 c S.P., 1750 RPM. Complete, cord, plug & pulley

WASHING MACHINE MOTORS Suitable for operating Small Compressors, Coffee Grinders, Bottle Washers, Etc. $19.75 EACH Reg. Value $32.50

MONEY BACK GUARANTEE
SHIPPING TERMS: 25% deposit required on all orders. Balance C. O. D. by Express: Sight draft with Bill of Lading attached by freight.
MANUFACTURERS' DISTRIBUTER
CHAS. H. JOHNSTON, Box 14, West End, Pittsburgh, Pa.

Any Boy or Girl Can Earn a College Education

Harold Geilich
Dartmouth College,
$2,500 Scholarship.

These Four Students and Hundreds Like Them Have Earned Their College Expenses by Giving Part of Their Spare Time and Vacations to Interesting, Dignified Field Work.

There is no house-to-house canvassing. There are no goods to be delivered. There is little or no difficulty in getting interviews. Each student is assigned an exclusive territory, often his own home town. He meets the best class of people and receives a business training worth almost as much as a year in college.

The field is enormous, and 92% of the students who have tried it have made big money.

Randolph Christie
University of California,
$3,700 Scholarship.

Ida Mines
University of Michigan,
$1,850 Scholarship.

Endorsed by

WOODROW WILSON, President of the United States
NICHOLAS MURRAY BUTLER, President Columbia University
EDWIN A. ALDERMAN, President University of Virgtnia
BENJAMIN IDE WHEELER, President University of California
HARRY PRATT JUDSON, President University of Chicago
GEORGE HARRIS, President Amherst College
ALBERT SHAW, Editor of the Review of Reviews

Frances Alexander
Franklin College,
$1,600 Scholarship.

Good for Five Years

These cash Scholarships are renewable from year to year for five years. They are easier to win each succeeding year. Many students have made from $1000 to $2000 towards college expenses by securing these Scholarships three or four successive years. Arthur Henkel made $4000 in 4 summers. Randolph Christie made $3700 in 4 summers. Jack Stern made $1900 in 4 summers. Paul Smith made $1600 in 3 summers. Vivian Draper made $1400 in 3 summers. Hundreds of students have won Scholarships for two or three successive summers.

P.S.M. 3-20
SCHOLARSHIP DEPT.
30 Irving Place
New York

Please send me, without obligation or cost to me, "VICTORY," the booklet that tells how to win a college education.

Name _____

Address _____

_____

School Attending _____

Your Opportunity

It costs nothing to enroll. High school, normal school, private prep. school, college and university students are eligible to work for a Scholarship. You have nothing to lose, everything to gain, by a trial of this plan. Throw your hat into the ring! Make up your mind now to succeed at this work, and stick to your determination. You will make good if you put your heart and mind into your work. Write today for "Victory," the booklet that tells the story.

Review of Reviews Scholarship Dept.
30 Irving Place New York

$10.00 FOR YOU. How would you like to make $10.00 a week during your spare time? Others are doing it by representing POPULAR SCIENCE MONTHLY. Why not *you?*
Popular Science Monthly 225 West 39th Street, New York

LEARN TO BE AN
AUTO and Farm Tractor MECHANIC
Earn $100 to $400 a Month

6 to 8 weeks' Personal Training here qualifies you to immediately accept a big paying position as a Trained Mechanic, or you can easily start a profitable business right at home, repairing your neighbor's Autos, Trucks, Farm Tractors and Power Machinery.

Learn Easily and Quickly

We can train any man, young or old, in a few short weeks. Personal training under same Master Mechanic Instructors who supervised training of thousands of Soldier Mechanics. Newest and best equipment ever used for training purposes. Come to Kansas City—"The Training Center for Motor Mechanics."

SPECIAL RATES NOW
Write today for information and 15-day Trial Offer **FREE**
Kansas City Auto & Tractor School
Dept. 772-A
Lydia & 15th, Kansas City, Mo.

Print Your Own
cards, circulars, labels, tags, menus book, paper. Press $3. Larger $25. Job Press $10 up. CUTS EXPENSE IN HALF. SMALL OUTLAY. Pays for itself in short time. Will last for years. Easy to use, printed rules sent. Print for others. BIG PROFIT. Write factory TODAY for press catalog. TYPE, cards, paper, envelopes.
THE PRESS CO., D-33, Meriden, Conn.

AGENTS: $4 an Hour

As salesman in your territory for this new Convertible Gas Burner. Makes any stove a gas stove. Burns common kerosene (coal oil): makes its own gas.

Fits Any Stove HEATS HOUSE COOKS MEALS

Easy to install. Just shove into the fire box. No trouble to operate. Clean, odorless. No more coal or ashes to carry. No kindling to cut. Wonderful labor saver. Low price.

15 Days' Free Trial

We want 100 men and women quick to take orders. The high price and scarcity of coal makes this burner sell everywhere. Big money for spare time workers. Acker made 8 sales last week working 2 hours in evenings. Carleton writes: "It's the easiest seller I have ever handled. I expect to take orders for 50 Burners right here in my neighborhood." Alton sold 12 first day. Write quick for sample and territory.

Thomas Burner Co. 247 Gay St. Dayton, Ohio

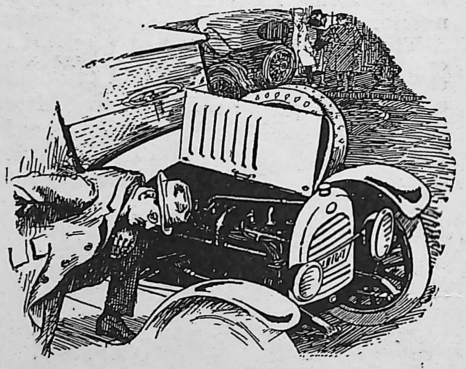
Every Knock Is a Boost if You Use Your Ears

ONE of the most delicate problems the amateur motorist has to deal with is that of distinguishing between and locating various engine knocks. While there are numerous "listening" devices on the market, experience is, as usual, the best teacher, and will enable you to repair it before it develops into serious trouble. A few of the mysterious knocks are described below.

The more experience one has in listening to knocks, the more expert will one become in finding them and telling what is loose. Each faulty motor part has a different knock, which comes always in regular periods relatively to the speed of the engine.

Locating the Trouble

A loose connecting-rod produces a sharp bump or a very heavy hollow sound. It is easy to locate the faulty connecting-rod by running but one cylinder at a time, in which case two bumps are usually noticeable, due to the relief of the explosion pressure. If the rod is very loose the knocks can be located by turning the engine with the crank. This trouble is caused by a twisted rod, loose bearing, scored bearing, burnt-out bearing, or side play. With a seized or burnt-out bearing the motor will groan or stick in starting.



Pull up the engine hood every so often and listen carefully. A little practice will enable you to detect trouble

The main-bearing knocks are readily located by running two cylinders at a time, one on each side of the crank bearing. A hard bump will be noticeable throughout the motor, produced regularly with the firing of the two cylinders. Such knocks are caused by end play in the shaft, loosely fitting bearings, or scored or a burnt-out bearing. In the latter two instances the motor will groan upon starting cold.

A loose piston-pin is distinguished by a sharp metallic knock. It can be located by using the listening rod for each cylinder and speeding up the motor, then closing the throttle suddenly. By doing so a double knock will be noticeable, which is very sharp and better termed a rap. The knocks

are caused by a crooked or broken pin or by a tight or badly worn member.

A loose crank-shaft is seldom encountered. It gives a rattling slap combined with a thud. In some cases only the thud is audible; in other cases the looseness of the bearings will allow the gears to slap and rattle. Generally this trouble is very hard to discover, due to the pressure of the valve springs. The trouble can be located by sounding gear-case and cam-shaft bearings with the listening apparatus. The knocks are caused by loose bearings, end play, or badly fitting bearings.

A loose flywheel will produce a very heavy knock at low engine speed, and will appear regularly. The knock will change its nature entirely when the motor is speeded up, and the vibration of the shaft will produce a dull, chattering knock. It is located by disengaging the clutch and rocking the flywheel back and forth. The trouble is caused by improper fitting, loose bolts, broken bolts, or bad keys and splines.

To Discover a Loose Piston

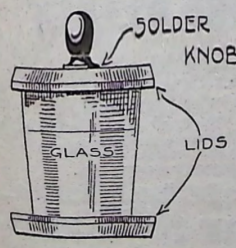
A loose piston gives a very short knock, its clearness varying with the size of the cylinder and metal used in the piston. It can be located very easily by the use of the listening apparatus against the cylinder wall. It is caused by a large bore, small piston, or taper piston or bore.

Loose valve tappets will produce a brisk tap or knock very often encountered, and difficult to remedy on a high-speed motor. This trouble is caused by an excessive clearance, bent or sticking valve stem, flat and out-of-round rollers, bent valve spring, or a seat that is not square, or a combination of causes.

Successful hunting for these troubles requires a great deal of experience that can be obtained only by continued practice, which develops the sense so that not only are the different knocks easily distinguished, but they are also speedily located.

To Make a Cover for the Medicine-Glass

TWO lids from "pry-top" cans can be put to excellent use by soldering a knob on one, as shown in the illustration, and then enameling both of them. The top with the knob acts as a dust-proof cover, while the



Make an attractive cover and tray for your drinking glass from tin can tops

other serves in the capacity of a tray to hold the glass. This is especially convenient for people who wake up in the night for a drink of water.—WILLIAM PAUL LANGREICH.

To cut down the cost per cut

Put on the Weight

If you're cutting with a medium or heavy power machine, start out with a good, full, 45-pound pressure after the first two or three strokes. As the number of cuts progresses, increase your weight. Remember that once the first keenness of the blade is gone, the heavier gauge of the blade the greater the pressure required to make the teeth "bite." Too little weight will ruin a blade almost as quickly as too much.

Follow the Starrett Hack Saw Chart in selecting your blades. Put on the weight and watch the cost per cut go down.

THE L. S. STARRETT CO.
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

Quality First

TOOL CASES for Machinists and Toolmakers

Write for our booklet showing the best built and most practical selection of Tool Cases on the market. We ship direct from factory and guarantee to please you or refund all money.

A. Gerstner & Sons.
50 Columbia St., Dayton, Ohio

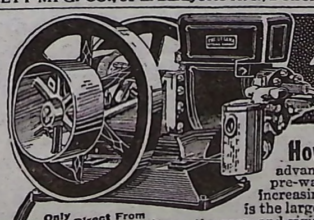
STAR STORAGE BATTERIES
More Dependable *Lower in Price*
The BEST Guarantee
Liberal discounts to dealers; write for particulars
THE STAR STORAGE BATTERY COMPANY
Manufacturers of
Automobile Starting and Lighting Batteries
MUNCIE, IND. U. S. A.

IF YOU HAVE METAL TO CUT YOU NEED
BARTLETT DROP-FORGED Compound Lever SNIPS $2 to $6.70
Made of high-grade Crucible Tool Steel, accurately tempered. Cuts metal up to 18 gauge easily. 7-inch size just right for household use. 7-inch, stamped, $2.00. 8-inch, forged, $3.00. 10-inch, $4.50. 12-inch, $5.80. 14-inch, $6.70. Your dealer has them or can get them from his jobber. If he will not we will ship prepaid in U. S. at above prices.

FOLDER ON REQUEST
BARTLETT MFG. CO., 31 E. Lafayette Ave., Detroit, Mich.

Small Steam Engines and Boilers

Gas and Gasoline Engines, ½ H. P. up; Tanks, Pumps, Gears Model Makers' Supplies. GetOur Big Catalogue sent postpaid for 15c (coin preferred) or stamps Refunded first order. 192 Pages – Over 200 Illustrations.
MODERN ENGINE & SUPPLY CO.
343 Monadnock Block, CHICAGO



Big Reduction in OTTAWA ENGINE Prices

Look At These Low Prices →

How This Was Done Although prices of raw materials are advancing daily, I reduced my prices to nearly pre-war level by cutting my manufacturing cost, increasing my factory production. Now my factory is the largest in America selling exclusively direct to the user, and giving the very highest quality engine.

Only Direct From My Big Factory To You.

Use Cheap Fuel There is no need to use expensive fuel. Ottawa engines use low grade kerosene, lamp oil, as well as gasoline, and they use less fuel having fewer moving parts.

90 Day Trial You have 90 days in which to try the Ottawa at your own work. Prove its reliability, easy starting, small fuel consumption—everything provided in my liberal 10-year Guarantee. Sizes 1½ to 22 H-P. Stationary, Portable, Saw-Rigs—all prices low.

Easy Terms or cash if you desire. A whole year to pay are my terms to any reliable man. Make your engine earn enough to pay while you use it. You can't afford to be without an Ottawa and you need not pay more than my price.

Special Offer To you men who read this good paper—I am making a real special money-saving offer. Get it before you select any engine at any price. My new free book will go with this offer. It is the finest ever printed. Send name and address today.

When I reduced my manufacturing costs, I reduced prices, giving you the benefit. I am no profiteer. Before deciding on any engine at any price get my Big Special Offer and Liberal Factory Prices
Geo. E. Long

FREE BOOK Full of Valuable Information

10 Year Liberal Guarantee

Geo. E. Long, Pres., OTTAWA MFG. CO., 1954 King St., Ottawa, Kans.

What the Best Machine Lacks

Lacking brains, initiative and perpetual motion, a machine remains but a tool in your hands—and what you get out of it depends on your idea of what it ought to give.

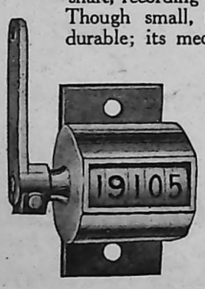
You can better size up the work-capacity of your machine by getting a running record of its *output*, under various conditions of mechanical adjustment and control.

Such records, put plainly before you by

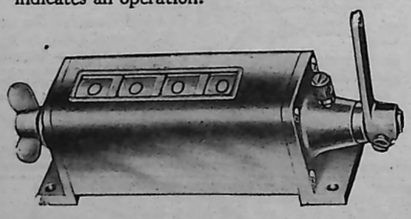
Veeder COUNTERS

give you the right idea of what to *expect* in amount of work, and help keep up what you find to be the *standard* production-rate for each machine.

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation. Though small, this counter is very durable; its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines, and most adaptable to experimental work. If run backward, the counter subtracts. Price, $2.00 *(Cut nearly full size.)*



The Set-Back Rotary Ratchet Counter below is for larger machines, such as punch presses and metal-stamping machines, where a *reciprocating* movement indicates an operation.



Registers one for each throw of the lever, and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, $10.50. *(Cut less than ½ size.)*

There's a Veeder for every purpose where you could possibly use a counter. Write for the new counter booklet.

The Veeder Mfg. Co.,
44 Sargeant St., Hartford, Conn.

Keep the Engine Clean and Prevent Fires

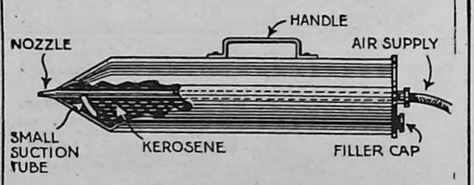
MOTORISTS usually pride themselves on keeping the car engine clean by giving it a bath in kerosene every so often; this is to remove the heavy grease deposits that accumulate on its exterior. To get

Where there are a number of automobile engines to clean, this contrivance is indispensable as both a time- and money-saver

into all the crevices, beneath the carburetor, and around the water-pump is almost impossible, for the brush used in the operation is much too large to permit this.

A gasoline or kerosene spray, under air pressure, will quickly remove grease and dirt from the engine of the chassis.

The contrivance that throws this spray is shown in the illustration,



As shown by the diagram, the cleaner is extremely easy and simple to make

being made at practically no cost, and will prove its weight in gold to the man who has much of this work to do.

A tank holds the liquid, and an aspirator is used for forming the spray. The aspirator is nothing more than a copper pipe which passes through the center of the tank, one end being connected to the air pressure line, and the other end being drawn down into a nozzle. A small copper tube connects this pipe, so that the cleaning solution is drawn from the tank and forced into a spray by the passing air. A foot pump can be used to inject air if no other pressure is available.

The foregoing proves that this cleaner is practical for quick work in either the public or home garage. It can be stowed away when not in use.—R. L. PRINDLE.

"I Made $3400 Last Wednesday"

Writes Mrs. Betty Smith from Florida. That's fine for Mrs. Smith—but it's not unusual for our agents are knocking out big money every day and everywhere. Write in today and find out about my great special offer.

100% to 200% Profit

Yes, 200% profit. This is my "Lucky 11" outfit. Costs you only 55c—retails at $3.50—*you sell* for $1.25 to $1.50. Anyone can sell at that undercut price. And it is one great outfit, too. The box is 6x13¾ inches, containing 11 regular drug store articles that everybody wants. Write today for details.

It's a Gold Mine!

That's what it is—a gold mine—sells like hot cakes—men and women coining 50 to 100 dollars a day—a baby could sell "Lucky 11" at this splendid undercut price. Don't delay a minute. You're losing bank notes and hard silver while you wait. Write me now for details.

Hurry Up—Write Today

I can't tell you all about it in this little space. Write me for full details, and I've got a special proposition for crew managers, too. Money, money, money, that's what you want and I can help you get it. Hurry up before you lose this ad or someone else gets your territory.

E. M. Davis Products Co.
Dept. 1363 Chicago, Illinois

LEARN PIANO TUNING AT HOME

Making Trials of True Tone by Tune-a-Phono

Capitalize YOUR Ability

THE WORLD PAYS FOR SKILL

This profession now offers unusual opportunities for making money. It is uncrowded, your time is your own. Our Correspondence Course with tools, and the wonderful Tune-a-Phone, our patented instrument of precision in sound, make the seemingly difficult easy to understand by anyone. Diploma given graduates. 16 years of successful correspondence teaching. Write for free book.

NILES BRYANT SCHOOL OF PIANO TUNING
1507 Fine Arts Institute BATTLE CREEK, MICHIGAN

Learn to Write

Begin Today—Write for My FREE BOOK
I can make a good penman of you at home during spare time. Write for my FREE BOOK, "HOW TO BECOME A GOOD PENMAN." It contains specimens and tells how others mastered penmanship by the Tamblyn System. Your name will be elegantly written on a card if you enclose stamp to pay postage. FREE BOOK—Write for it Today.

F. W. Tamblyn, 437 Ridge Bldg., Kansas City, U.S.A.

AGENTS $60 WEEKLY

Robinson Folding Bath Tub. Big Seller. Costs little, no plumbing, little water. Weight 15 pounds; folds into small roll. Full length baths, far better than tin tubs. Guaranteed 10 years. $10 a day easily made. Write for free tub offer.

ROBINSON CABINET MFG. CO.
5159 Factories Building, Toledo, O.

Learn How to Write Short Stories

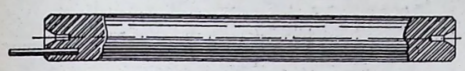
There is a big demand for short stories, photoplays and feature articles. You can learn how to write at home in spare time. **Jack London said so.** He and other great writers have endorsed our home study course. Course in fascinating and takes only a few of your spare hours.

Write for free book and details of our Limited Introductory Offer. No obligations.
Hoosier Institute, S. S. Dept 1203 Ft. Wayne, Ind.

How to Turn Accurate Gage Pieces

IN some kinds of work it is necessary to use accurate cylindrical pieces as gages for setting up parts in alinement. Since these pieces are of special sizes and often used only once or twice, grinding or other expensive methods of making could not be considered.

If a piece is ordinarily turned in a lathe by using a dog on either end,



How to eliminate expensive methods and still be able to turn out accurate gage pieces

chucking one end, etc., certain small inaccuracies are bound to result. Accordingly, drill a hole in one end and force a pin in it to act as a dog. In this manner the piece is produced entirely on center and at one setting, besides resulting in absolute accuracy.—S. B. ROYAL.

A One-Man Sack-Filling Contrivance

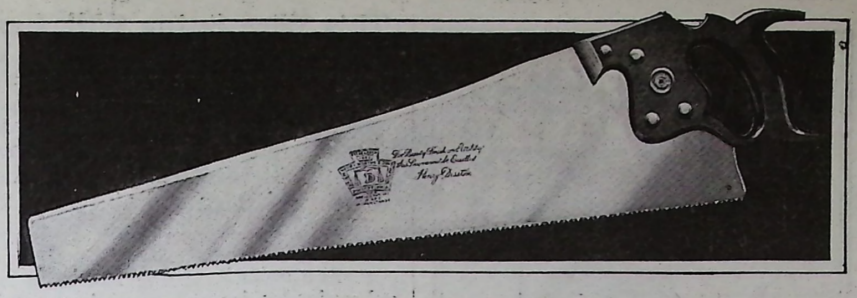
THIS device for holding sacks while filling them should save backache and many useless adjectives.

It is made of half a pickle-barrel with the ends knocked out, attached by a small block of wood to the side of a bin or granary.

Five or six nails, driven through the sides of the barrel from the inside and pointing at an upward angle when the

With this arrangement for holding the sack, one man can do the work of two in filling

barrel is in place, hold the sack in place during the filling. The sack is pulled up over the bottom of the barrel as shown. It should be at the right height from the floor for filling, at the same time resting on the floor to prevent strain on the nails and tearing the sack.—DALE VAN HORN.



"Son, this saw is part of your education—

"It will give you the practical experience you need to develop the talent that's in you.

"Another thing, son—this saw is balanced, sharpened and set as accurately as a delicate instrument is adjusted. And with proper care it will stay that way.

"A Disston Saw holds its set and cutting edge under all working conditions. That's because it's made of Disston Crucible Steel, tempered and hardened to meet exactly the requirements of hand saws."

A Disston Saw develops initiative, resourcefulness, and creative ability. It cuts so clean, so fast, so true that its use is a constant inspiration toward good work.

Disston Hand Saws are made in various styles—a saw to meet each specific requirement. Sold by dependable dealers everywhere.

Write for the Disston Booklet on Saws—it tells how to select, use, and care for Disston Saws and Tools.

HENRY DISSTON & SONS, Inc.
Philadelphia, U.S.A.

"America's Largest and Longest-Established Makers of Hand Saws, Cross-Cut Saws, Band Saws, Circular Saws, and Tools."

Canadian Distributors:
Henry Disston & Sons, Ltd., Toronto, Canada

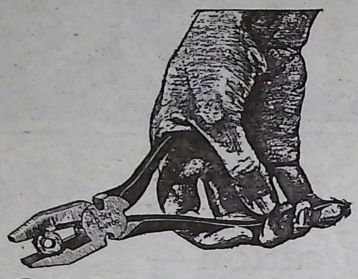
New York Chicago Cincinnati San Francisco
Boston Seattle New Orleans Memphis
Vancouver, B.C. Bangor, Me. Portland, Ore.
Sydney, Australia

DISSTON

Every Home Needs the Saw Most Carpenters Use

DISSTON
SAWS AND TOOLS

"Fingers of Steel"



Good Work Well Done

There is satisfaction in working with good tools. The work goes more easily and quickly, and results are better.

Red Devil Pliers speed the work. They are made to stand years of hard service, and they are strong enough to do work pliers are seldom called upon to do.

Red Devil PLIERS

Properly designed pliers are particularly handy. You can use them as you use your fingers when you work.

Red Devil Pliers multiply the strength of your hand and wrist; they grip as your fingers can't possibly grip—no slipping, no barked knuckles, and no exasperation from trying to do good work with poor tools.

All Red Devil Hand Tools are made as well as tools can be made.

Pliers
Electrician's Tools
Glass Cutters
Hack Saw Frames and Blades
Auger Bits
Chain Drills
Etc., Etc.

Red Devil Corrugated Lock Washers have 6-point contact. They are the best washers made, and "hold fast."

Tool Booklet on Request

SMITH & HEMENWAY CO., Inc.
Sales and Export Office
264 Broadway, New York
Factory: Irvington, N. J.

This Wire Swing Will Last for Years

WHEN the ordinary swing is made from rope and attached to the limb of a tree or some other high support, it will be noticed that the seat sometimes is high and at other times very low. This is due to atmospheric conditions.

A fine substitute for the rope is a galvanized wire, such as is used by linemen for guying-poles. This, however, cannot be wrapped around the tree limb like a rope, as the constant bending back and forth would soon break it off.

The wire swing is not affected by atmospheric conditions as is the old-time rope swing

Obtain a pair of heavy barn-door hinges; fasten one end to the tree, then attach the wire to the other end of the hinges, as shown in the illustration. An occasional oiling or greasing will make the swing last for years and withstand the elements as a rope swing would not.—VICTOR H. TODD.

An Automatic Drinking-Cup for Poultry

FIVE or six times a day the pail containing the chickens' drinking water must be refilled. But why not simplify the task and supply the drinking water from a reservoir that automatically regulates the flow of water?

This automatic drinking-cup consists of three simple parts: a small but deep enamel dish, a bottle, and a support. The support consists of a board 8 in. wide and one third longer than the bottle. The lower part of the board receives a small shelf slightly larger than the cup that is placed upon it. Then the bottle is laid upon the board and two strips of tin are so nailed to it that they will hold the bottle in the position shown in the photograph. The support can now be attached to the chicken-house,

Students trained by members of our Faculty are filling high-salaried positions. Artist's Outfit FREE to Enrolled Students.

Write today for Art Year Book.

SCHOOL OF APPLIED ART
APPLIED ART BLDG., No. 8 BATTLE CREEK MICH.

LEARN THE AUTOMOBILE BUSINESS

Great opportunities for trained men as Motor Experts, Shop Foremen, Licensed Chauffeurs, or in business for yourself.

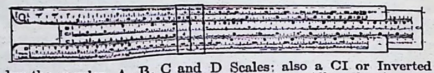
YOU CAN EARN $100 to $400 Per Month

You learn here by putting on overalls and doing the actual work, under expert instructors. By this method you cannot fail. If you have yearned for a future where you can make big money—here it is.

Write TODAY for information.

BUFFALO AUTO SCHOOL
Dept. 118, Buffalo, N. Y.

RICHARDSON'S POLYPHASE SLIDE RULE



has the regular A, B, C and D Scales: also a CI or Inverted Scale, Logarithm, Sine and Tangent Scales. All graduations are printed on white coated steel from engine divided plates. These Scales are accurate and will retain their accuracy indefinitely. They are not affected by acids, alkalies, water or grease. Length of rule 10 inches. A 100 page Instruction Book, which teaches all there is to know about slide rules, is sent with each order.

Price of the Richardson's Polyphase Slide Rule, in case, with a 100 page Instruction Book, $2.00.

An ideal slide rule. It is low-priced and an equal to any other rule in appearance, accuracy and durability. Be convinced. Your money will be promptly refunded if you are not satisfied.

GILSON SLIDE RULE CO., Niles, Mich.

One Man Saws 25 Cords a Day

The Ottawa Log Saw does the work of ten men Makes wood sawing easy and profitable. When not sawing wood use for pumping, feed grinding, etc. Simple, economical, durable Thousands in use. Fully guaranteed; 30 days trial Write at once for Free book and low price.

OTTAWA MFG. CO., 1801 Wood St., Ottawa, Kas.

Make Money—Be an AUCTIONEER

Missouri Auction School, the largest Auction School in the world. Four weeks course fits you to make big money. Col. A. W. Cies, Chillicothe, Mo., made $1000 one day; Col. E. Walters, Skedee, Okla., made $1746 one day. If you want $50 to $100 a day write today for free 67-page annual and read the stories of successes made by our graduates. Simply send name—let us tell you how to be a Successful and Prosperous Auctioneer. W. B. CARPENTER, Pres., Missouri Auction School, Dept. L 818 Walnut Street, Kansas City, Mo.

Learn to Dance!

You can learn Fox-Trot, One-Step, Two-Step, Waltz and latest "up-to-the-minute" society dances *in your own home* by the wonderful Peak System of Mail Instruction.

New Diagram Method. Easily learned; no music needed: thousands taught successfully.

Write for Special Terms. Send *today* for FREE information and surprisingly low offer.

WILLIAM CHANDLER PEAK, M. B.
Room 107, 621 Crescent Place—Chicago, Ill.

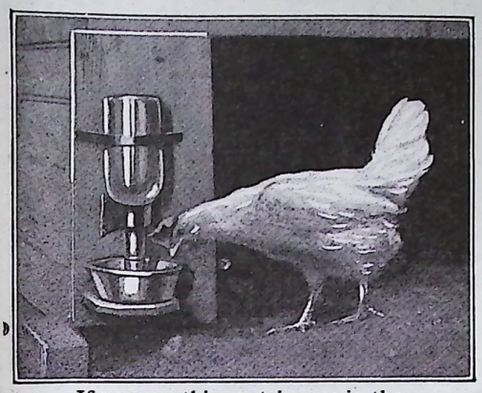
WIRE electrical, rope, airplane, piano, pipe-organ, flat, hoops, bale-ties, tacks, nails, barbed-wire, concrete re-inforcement, springs, netting, wire fences, steel posts, trolley-road wires and rail bonds, wire wheels, auto-towing cables, horse-shoes.

Illustrated Books Describing Uses, FREE

American Steel & Wire Co. F. Baackes, V.P. & G.S.A. CHICAGO

the cup being two or three inches above the ground.

When the bottle has been filled with water it is quickly inverted over the cup. Water will run out of the bottle



If you use this contrivance in the hen-yard your poultry will never be thirsty; it refills automatically.

until the surface just touches the neck. The water used is replaced by fresh water running out of the bottle. The bottle need be refilled only when it is empty.

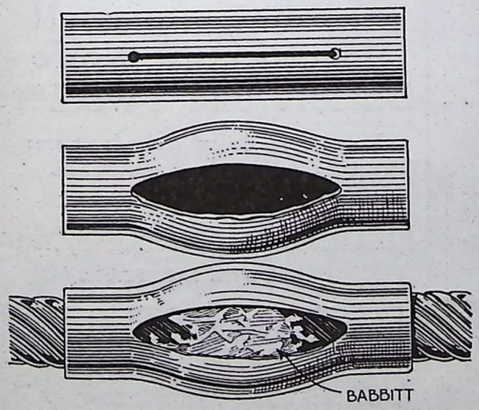
As can be seen from the illustration, the chicken cannot stand upon the water-pan and overturn it, for it is set against its stand in such a way as to prevent this.—ERNEST BADE.

How to Install a Cable on an Elevator

WHILE installing a new operating cable on an elevator, I found that a short piece had been spliced in and had simply been tied in several bulky knots.

Slipshod work of this kind is the reason why many accidents happen in the large mills and factories throughout the country.

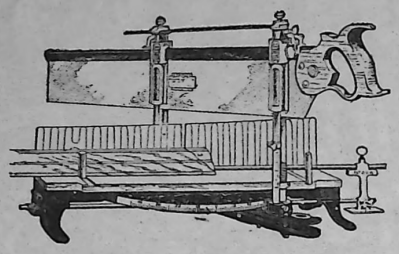
A better and more workmanlike way to do this job would have been to use a piece of pipe about 8 in. long and



Make a neat splice in the elevator cable in the manner here indicated

of a diameter large enough to allow the cable to enter easily. Slit the pipe for about 4 in., and spread the halves with a chisel, as shown in the illustration. Place the ends of the cable in the ends of the pipe, spread the strands, pour in hot babbitt and the job is finished.—ERNEST SCHWARTZ.

Stanley Tools



Stanley Mitre Boxes

Strong—Durable—Accurate

A Few Striking Features

Saw is held above work when not in use.

Swivel is automatically locked at any angle.

Two sockets in swivel for use of long or short saw.

Narrow opening in back of frame, especially adapted for small work.

Steel rod uprights for saw guides.

Uprights adjustable for saws of varying thicknesses and for those that run out of true.

Stock guides for holding work in place.

Extra wide range for work—will saw at angle of 30 degrees.

One-Piece frame with detachable malleable iron legs.

Construction thoroughly mechanical; all parts interchangeable and readily replaced if lost.

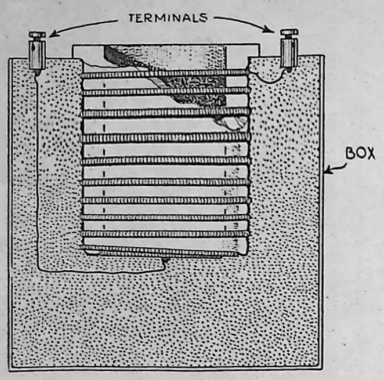
Quickly and easily put together or taken apart for carrying.

A specially made back saw furnished with each box

STANLEY RULE & LEVEL CO.
NEW BRITAIN. CONN. U.S.A.

Making an Electric Furnace for the Laboratory

A SMALL electric furnace of the resistance type, much superior in most respects to the arc furnace and possessing a high degree of efficiency,

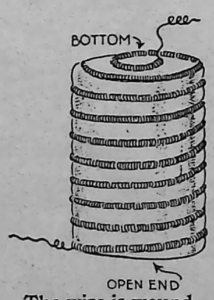


A cutaway view of the electric furnace—a contrivance that will be a valuable addition to any laboratory

will be found exceedingly useful in the laboratory. To make it, secure a corrugated Alundum core 2½ in. deep and 2 in. in diameter. Hollow cores, open at one end and closed at the other, can be obtained for this purpose.

Next, wind as closely as possible 42 ft. of bare No. 20 resistance wire on a spindle 3/32 in. in diameter, leaving one ft. free at each end for connections. This will be better if machine-wound. When the coil has set, stretch it slightly so that the turns will not touch, and, starting with one end at the center of the grooves on the bottom of the core, wind it about the cylinder and secure it in position temporarily with cord. Cover the whole with a layer of Alundum cement to a depth of ⅛ in., and connect directly to a 110-volt lighting circuit. The heat developed will very quickly cause the cement to set.

Now, for prevention of heat losses and greater convenience in use, insulate this unit with a mixture of fire-clay, asbestos fiber, and water-glass as follows: Secure or make a cubical box about 5 in. on an edge, and pack in the bottom of it a doughy mass of the above mixture, using water-glass in the form of a solution. Set the heating unit in the center and just flush with the top, bringing the free ends of the wire out for connections. Then pack the mixture about it firmly, making a smooth, even surface on the top. Make a tightly fitting cover of the same material, and fill the cavities of both with a cement of fire-clay and water-glass. With the cover in place, turn on the current, and when thoroughly dry and hardened break



The wire is wound as closely as possible on the spindle

WITTE ENGINES

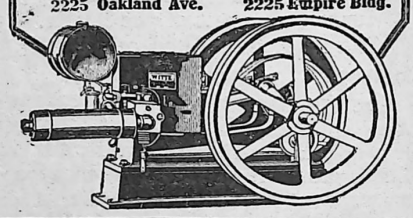
Save $15 to $500

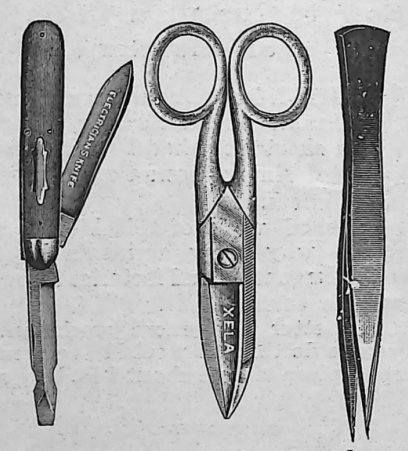
Built in the Largest Exclusive Engine Factory in the World Selling Direct. Quality and Service proven by 34 years success. You can always get delivery from WITTE, and the best rig for the price. Write for latest catalog and price of WITTE Engines with

BOSCH Standard Ignition

I can furnish you a Stationary, Portable, or Saw-Rig outfit—Kerosene or Gasoline—or a Lever-Controlled Drag Saw with all latest improvements. WITTE Engines are regularly equipped with H. T. battery, or Standard BOSCH Magneto on order. Lifetime Engine Guarantee against defect—no strings—no time limit—no excuses. Tell me what you want and when you want it. I can ship quicker than any other factory selling direct.

WITTE ENGINE WORKS
Kansas City, Mo. 2225 Oakland Ave. Pittsburgh, Pa. 2225 Empire Bldg.





Electricians' Knife Scissors and Tweezers

We can meet dealers' demands at once and offer attractive quantity prices

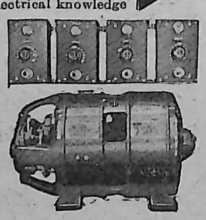
Write for description

MATHIAS KLEIN & SONS, Mfrs.
CANAL STA. 3, CHICAGO

BIG PROFITS for YOU in HB BATTERY CHARGING

Make $150 to $350 Clear Profit Each Month
Others are doing it—why not YOU!

Start now to build big money-making business charging auto batteries. No experience or electrical knowledge necessary. This HB 32-battery Charger re-charges 1 to 32 6-volt batteries at once for 10c to 15c each. Owner pays 75c to $1.50. Figure those profits.



Small Payment Puts this Money-Maker in Your Garage or Shop

Balance on easy monthly terms. Profits will easily pay for outfit. No burnouts, no expensive renewals—steady 24 hours a day service with BIG PROFITS. Absolute Money-Back Guarantee. Tear out this ad and mail TODAY for information.

Hobart Brothers Company, Box S33, Troy, O.
Successful Manufacturers Since 1893

Easy to start
Easy to control

The transmission and starting system of no other motorcycle can give such complete satisfaction as that of the INDIAN Scout. The accompanying illustration and description show why. Ease of control, however, is further assured by the low placing of the center of gravity and in general by the scientifically correct distribution of weight.

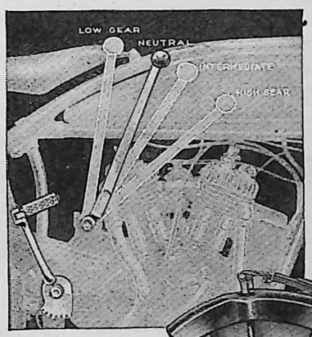
There are other features that contribute toward making the INDIAN Scout a truly remarkable engineering feat. It is 100 pounds lighter than the Powerplus, yet nothing has been sacrificed in strength and sturdiness. It has power and speed—delivering 11½ h. p.—its mechanical parts are easily accessible, and it yields 75 miles to the gallon of gasoline.

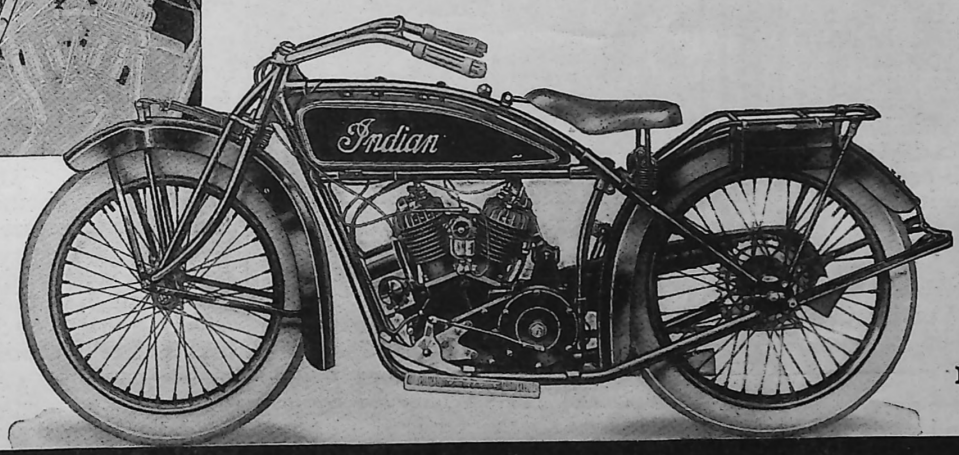
Examine the latest INDIAN achievement at your INDIAN dealer's. Get a practical demonstration today.

HENDEE MANUFACTURING COMPANY
Department 38
Springfield, Massachusetts
The Largest Motorcycle Manufacturer in the World

Control Unit—The long gear shift lever, within easy reach of driver's right hand, acts directly on sliding gears in transmission and makes possible sure and easy change of gears. Lever moves smoothly on a forward and backward arc and is always in adjustment. Lost motion is absolutely eliminated.

Positive-acting kick starter (new type) operates on main shaft of transmission. One back-kick spins motor several times. No adjustments. Easily operated from saddle. Starter arm held ready for use by a spring stop.



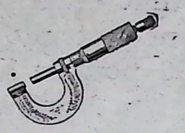


Indian Scout
Model G-20

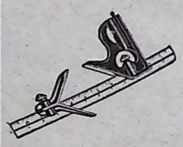
Indian Motocycle
For Sale by Dealers Everywhere

Your Success

depends not only on your technical equipment but on your every day working equipment.



Your tool kit should contain enough tools to meet your every day requirements so that you can work accurately and quickly, these two points are the basis for promotion in practically every shop.

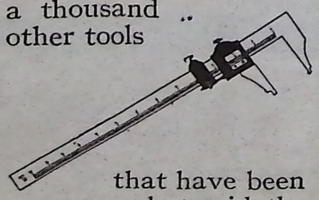


A well made reliable micrometer is an actual necessity. Its uses are unlimited. It should be in every kit.

Another practical tool is the combination square. In laying out a drill job or squaring up a piece it is of great help.

If you have many jobs that demand accuracy a Vernier Caliper will be of great assistance.

There are over a thousand other tools



that have been made to aid the machinists listed in our No. 27 Catalog.

Send for it

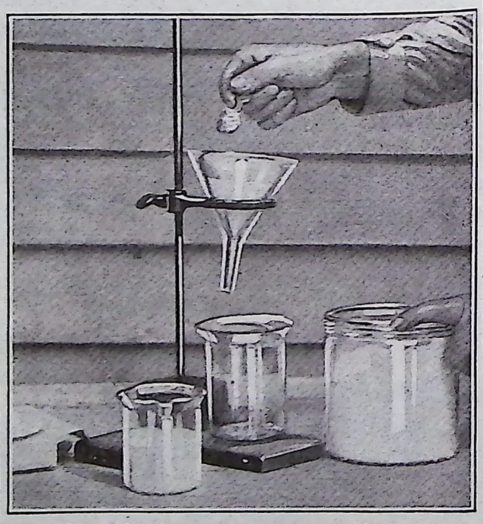
Brown & Sharpe Mfg. Co.
PROVIDENCE, R. I., U. S. A.

away the box and retouch the surface with the fire-clay and water-glass cement. The ends of the wire may be secured to binding-posts set in the cement, if desired.

Such a furnace as this may be made at very small cost, and it will serve as well as a bought furnace for which you would pay a considerable sum. In it precipitates may be ignited, fusions made, and alloys melted. It will give a temperature of 1,000° C. for an indefinite period or 1,200° C. for a short time. By means of a suitable resistance in series with the furnace any desired temperature may be obtained, and for prolonged use such a resistance will be essential. The capacity of the furnace is such that it will take crucibles of several sizes.—FLOYD L. DARROW.

Separating Water from Oil by Filtration

TO separate large quantities of water from oil, first let the liquid stand for twenty-four hours, at the end of which time all the oil will be floating on top, and then use a separatory funnel. If the oil and the water

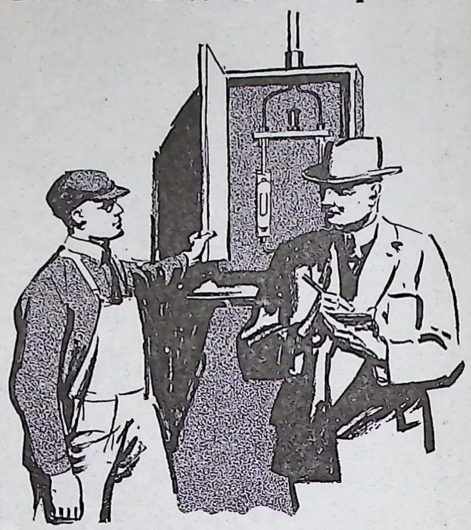


Here is the way to separate oil from water. A funnel, filter paper and a container are all that is necessary.

do not separate easily, a few cubic centimeters of benzol stirred into the liquid will accomplish your object. The benzol can be removed by distilling over a water bath.

Sometimes, when there is only a small quantity of water intimately mixed with the oil, the water and oil will not separate, no matter how long the liquid is left standing. In such cases water must be removed by filtration. The filter paper is placed in the funnel in the usual way, and the paper is filled with common table salt. Now the liquid is poured on the salt until all of the oil has filtered. The salt is not dissolved by the oil, and there is not enough moisture present in such a solution to dissolve it, but it absorbs the moisture and allows the oil to drain through thoroughly dry.—ERNEST BADE.

Your Work Will Pass Inspection



Electrician's Wiring Manual

By F. F. Sengstock, E. E.

This book contains all the essential information needed for the proper installation of lighting and power systems in houses and other buildings. It is written in simple, plain English by an Electrical Engineer with many years' experience on the Chicago Board of Underwriters.

Profusely illustrated and contains many tables and formulas.

1920 edition, 448 pages, 415 illustrations.

Pocket size, flexible binding; **Price,** postpaid, **$2.50.**

Book Dept., Popular Science Monthly
225 West 39th Street, New York

Twentieth Century Book of

Recipes, Formulas, and Processes

Edited by GARDNER D. HISCOX, M. E.

The most valuable techno-chemical formulæ book published, including over 10,000 selected scientific, chemical, technological and practical recipes and processes. This book of 800 pages, gives thousands of recipes for the manufacture of valuable articles for everyday use. Hints, helps, practical ideas and secret processes are revealed within its pages. It covers every branch of the useful arts and tells thousands of ways of making money.

The pages are filled with matters of immeasurable, practical value to the photographer, the perfumer, the painter, the manufacturer of glues, pastes, cements and mucilages, the physician, the druggist, the electrician, the brewer, the engineer, the foundryman, the machinist, the potter, the tanner, the confectioner, the chiropodist, the manufacturer of chemical novelties and toilet preparations, the dyer, the electroplater, the enameler, the engraver, the provisioner, the glass worker, the goldbeater, the watchmaker and jeweler, the ink manufacturer, the optician, the farmer, the dairyman, the paper maker, the metal worker, the soap maker, the veterinary surgeon, and the technologist in general. Contains an immense number of formulas that everyone ought to have that are not found in any other work. New edition. Cloth binding. **Price, postpaid, $4.00.**

Book Dept. POPULAR SCIENCE MONTHLY
225 West 39th St., New York

Brunswick Again Brings a New Idea to Music Lovers

First came The Ultona which introduced an all-record phonograph. Then the Brunswick Tone Amplifier which brought better tone. NOW Brunswick Records, interpreted by great directors.

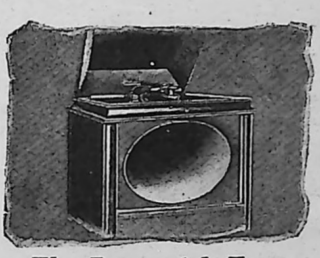
The Ultona

In all the history of phonographic art there are no chapters more interesting than those allotted to Brunswick.

It rested with this old-time house to introduce the Brunswick Method of Reproduction and the advancements it provides.

For years phonograph music had seemed to reach its heights. But people have found that in The Brunswick old standards must be forgotten.

Rare Tones Ever Present



The Brunswick Tone Amplifier

Experts in acoustics have long agreed that better reproduction could come only with a new-type reproducer and a different way of amplifying the sound waves. That was the urge which made the House of Brunswick discover the Ultona and the Brunswick Tone Amplifier.

Of the major phonographs, The Brunswick was the first to play *all records* correctly. This is accomplished by the Ultona, a simple, multi-record reproducer which presents to each make of record, at the turn of the hand, the proper diaphragm and needle. This was a tremendous step forward.

Then came the Brunswick Tone Amplifier—built entirely of wood, like a violin. We avoid the use of metal which, having no elasticity, prevents the sound waves from expanding properly. Thus, we overcame the old-time harshness.

With these two inventions the Brunswick Method of Reproduction brings a phonograph the like of which cannot be equaled in versatility nor tone. All we ask to prove it is that you hear The Brunswick. Compare it with others. Your own ear will decide.

And NOW Brunswick Records

We are introducing, after years of preparation, Brunswick Discs. They, too, are unlike any you have known before. They bring a new principle in phonographic recording. Each is interpreted by a noted director. Thus, we unite the talent of the artist with the genius of the composer. This is a step which you will appreciate once you make comparisons.

Brunswick Records

Brunswick Phonographs and Brunswick Records are found throughout the country at leading dealers.

Brunswick

PHONOGRAPHS AND RECORDS

THE BRUNSWICK-BALKE-COLLENDER COMPANY

General Offices: 623-633 South Wabash Avenue, Chicago

Branch Houses in Principal Cities of United States, Mexico and Canada

Canadian Distributors: Musical Merchandise Sales Co., 819 Yonge Street, Toronto

Architects and *contractors* specify Johnson's Wood Dye for coloring woodwork and flooring in new buildings. ***Painters*** and ***decorators*** use it with equal satisfaction on new and old woodwork of all kinds. ***Housewives*** delight in it for doing over old furniture and for coloring reed and wicker baskets, etc. ***Manual training*** teachers and pupils use it for finishing their models. ***Upholsterers, furniture repairers*** and ***cabinet makers*** find it "just the thing" for their work—old and new

JOHNSON'S WOOD DYE

is a combination spirit-oil stain for the artistic coloring of all wood—soft or hard. It is very easy to use—any one can apply it without laps or streaks. Made in all the popular shades.

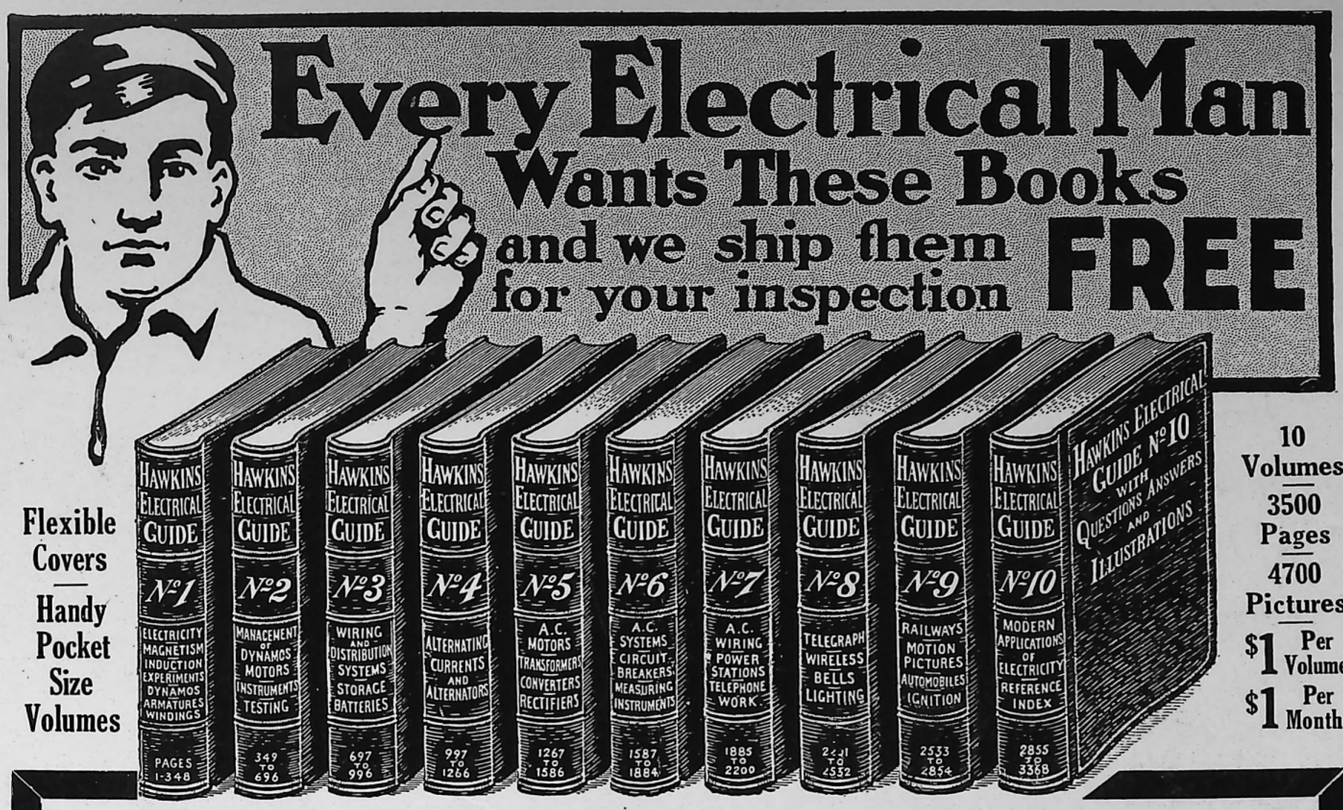
For a finish over the Dye we recommend Johnson's Prepared Wax, Shellac or Varnish. Full instructions are given on every label.

Johnson's Wood Dye comes in all sizes—from half-pints to gallons. It is conveniently put up in reseal glass jars. Insist upon your dealer supplying you with "Johnson's"—do not accept a substitute.

S. C. JOHNSON & SON

"The Wood Finishing Authorities"

Racine, Wis.
U. S. A.



Just what you need to know to succeed in ELECTRICITY

YOU need specialized knowledge today if you are to master electrical forces and command the high salary of an electrical expert. Success in electricity will come through your ability to acquire and use the specialized knowledge of others—knowledge collected and condensed in Hawkins Electrical Guides.

Just think how much these books will help you. In Hawkins Electrical Guides you always have at hand for immediate reference or study, a wonderful work containing 4,700 illustrations and 3,500 pages which cover all the subjects, principles, theories, practices, problems, troubles and ways of doing things electrically.

The set contains ten wonderfully helpful and practical volumes—written in clear, concise language—easy to understand—no wasted words—full of up-to-the-minute electrical knowledge which you can apply to the problems that come up.

HAWKINS
ELECTRICAL GUIDES

The Guides fit your pocket. You can carry a number about with you till you have mastered its contents. All subjects are indexed so that you can find the information instantly. Written in the modern question and answer form. It's like having a famous electrical authority always at your elbow ready to answer any question you ask.

Shipped to You FREE

Send no money. Examine the books first—use them in your work—pick up some information that will increase your earning ability. Decide for yourself that they are the most complete and clearly written electrical books ever published. Every book is complete in itself but the entire set is the best bargain. Accept this unusual offer now—mail the coupon today. If you decide to keep the books you can make settlement at only $1 per month until paid for.

Do you want to know the facts about the following electrical subjects? They are all covered in Hawkins Electrical Guides. Read this partial list of Contents.

No. 1 Contains 348 pages, 388 illustrations. Electrical signs and symbols—static and current electricity—primary cells—conductors and insulators—resistance and conductivity—magnetism—induction coils—dynamo principles—classes of dynamos—armatures—windings—commutation—brushes, etc.

No. 2 Contains 348 pages, 394 illustrations. Motor principles—armature reaction—motor starting—calculations—brake horsepower—selection and installation of dynamo and motors—galvanometers—standard cells—current measurement—resistance measurement—voltmeters—wattmeters—watt hour meters—operation of dynamos—operation of motors, etc.

No. 3 Contains 300 pages, 423 illustrations. Distribution systems—wires and wire calculations—inside, outside and underground wiring—sign flashers—lightning protection—rectifiers—storage battery systems, etc.

No. 4 Contains 270 pages, 379 illustrations. Alternating current principles—alternating current diagrams—the power factor—alternator principles—alternator construction—windings, etc.

No. 5 Contains 320 pages, 614 illustrations. A. C. Motors—synchronous and induction motor principles—A. C. commutator motors—induction motors, transformers; losses, construction, connections, tests — converters — rectifiers, etc.

No. 6 Contains 298 pages, 472 illustrations. Alternating current systems—switching devices—circuit breakers—relays—lightning protector apparatus—regulating devices—synchronous condensers—indicating devices—meters—power factor indicators—wave form measurement, switch boards, etc.

No. 7 Contains 316 pages, 379 illustrations. Alternating current, wiring power stations—turbines; management, selection, location, erection, testing, running, care and repair—telephones, etc.

No. 8 Contains 332 pages, 436 illustrations. Telegraph—simultaneous telegraphy and telephony—wireless — electric bells — electric lighting — photometry, etc.

No. 9 Contains 322 pages, 627 illustrations. Electric railways—electric locomotives—car lighting—trolley car operation—miscellaneous applications—motion pictures—gas engine ignition—automatic self-starters and lighting systems, electric vehicles, etc.

No. 10 Contains 513 pages, 599 illustrations. Elevators—cranes—pumps—air compressors—electric heating—electric welding—soldering and brazing—industrial electrolysis—electro plating—electro-therapeutic—X-rays, etc.

Also a complete 126-page ready reference index of the complete library. This index has been planned to render easily accessible all the vast information contained in the 10 electrical guides. There are over 13,600 cross references. You find what you want to know instantly.

FREE EXAMINATION COUPON

THEO. AUDEL & CO. 72 FIFTH AVE. NEW YORK

THEO. AUDEL & CO.
72 Fifth Ave.
New York, N.Y.

Please submit me for examination **Hawkins Electrical Guides (price $1 each).** Ship at once, prepaid, the 10 numbers. If satisfactory I agree to send you $1 within seven days and to further mail you $1.00 each month until paid.

[USE PENCIL]

Signature .....

Occupation .....

Employed by .....

Residence .....

Reference ..... P.S. Mar. '20

The Razor Complains to the Strop

A Fable by "C's Soap"

THE Razor and the Strop were discussing their Master and his choice of Shaving Soap.

"He is unfair to us, and to me particularly," complained the Razor, "because he does not use a soap that is both softening and soothing. When he gets a poor shave he blames us, saying that between us we do not give him a keen edge."

"That is true," said the Strop. "But what can we do?"

"I have hope for the future," replied the Razor. "Today I heard him say that he was going to try the Colgate Shaving Stick, that his brother likes so much."

The next morning Colgate's Stick softened the Master's beard so thoroughly and left his face so cool and refreshed that he gave great praise to both the Razor and the Strop, and justly complimented the new Shaving Soap.

This Fable teaches that all is not soap which lathers—and that over a century of experience enables a manufacturer to make a Shaving Soap which helps both razor and strop and makes shaving a pleasure.

COLGATE'S

A trial size of Colgate's—Stick, Powder or Cream—sent for 4c. in stamps.

COLGATE & CO. Dept. R 199 Fulton St., New York